SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII.—No. 17.] [NEW SERIES.] NEW YORK, APRIL 27, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

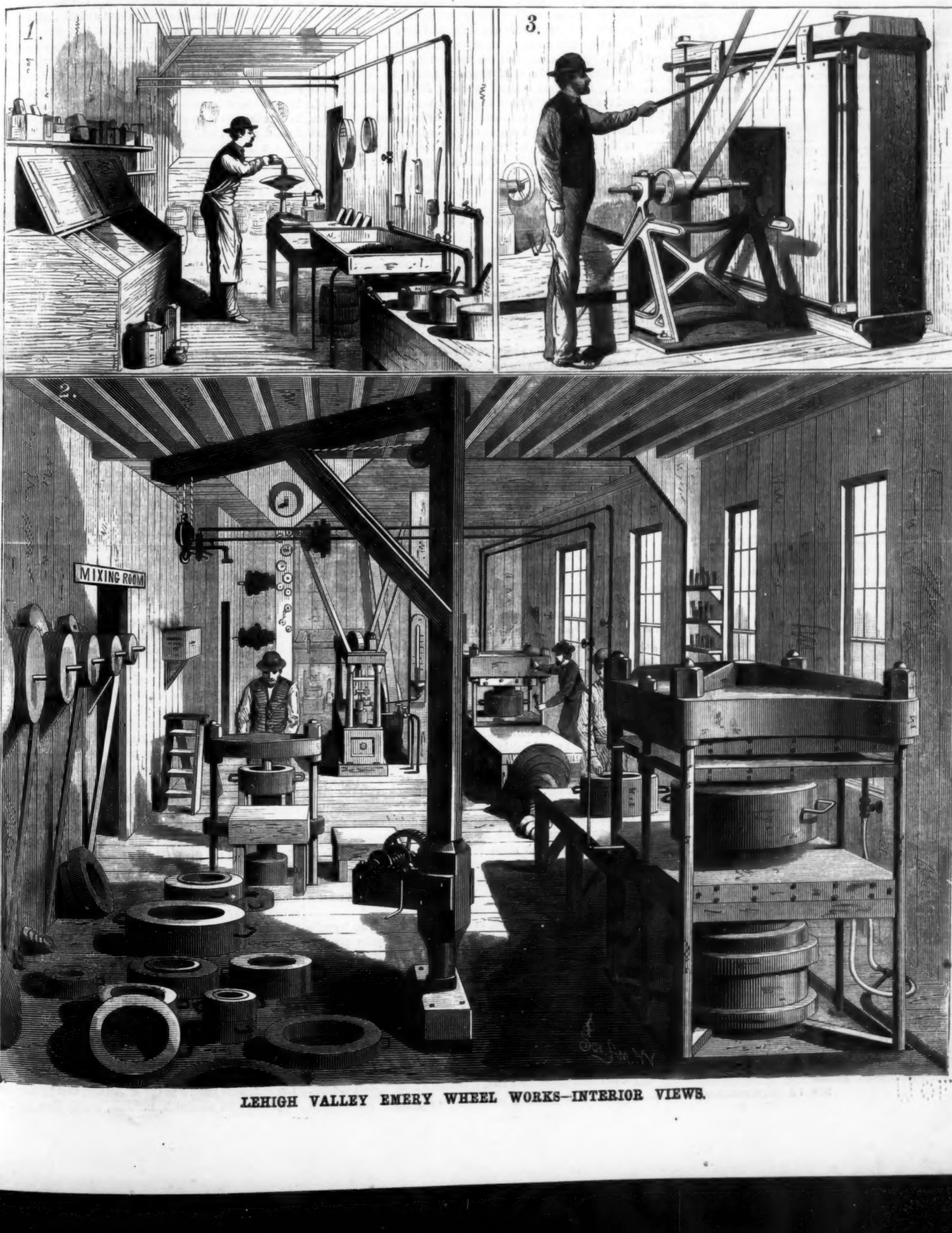
THE MANUFACTURE OF EMERY WHEELS.

The chief essentials for good emery wheels are the following: They must not glaze or gum; they must not be offensive in odor or injurious to health; be strong enough to hold without danger of bursting or breaking off when in operation; and have rapid, cool, and free cutting qualities. Various qualities of wheels are required for specific purposes; for instance, a wheel to grind stove or other iron castings has to have certain qualities different from those intended for grinding steel, tools, twist drills, and so on.

By using the different grades of emery in connection with the peculiar process of tempering, by which the wheels are made to any degree of hardness required, the manufacturers are enabled to adapt them to almost every variety of work. In ordering an emery wheel, therefore, the grade of emery is not one of the essentials; its construction should be left to the judgment of the manufacturers, who should be informed and have a thorough knowledge of the work it is expected to do, and whether it is intended to cut the edge or surface of the metal; then the wheel is made of that composition and with that peculiar manipulation which will render it best adapted for the specified purpose. In order to produce wheels of uniform excellence in all grades, much attention has been paid to the method of manufacture, and of late many valuable improvements have been made in their composition, form, adhesive and cutting qualities.

The engravings herewith presented illustrate the manner of making emery wheels, as practiced at the works of the Lehigh Valley Emery Wheel Company, Weissport, Carbon county, Pa. The principal departments of interest are the stock room, where the materials for emery wheels are kept, as Turkey emery and corundum of all grades, the adhesive matter, and the different substances used as bodies; the mixing room, shown in Fig. 1, where the different materials are thoroughly incorporated; the drying room, where they are

[Continued on page 258.]



LEHIGH VALLEY EMERY WHEEL WORKS—INTERIOR VIEWS.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included	$3 20
One copy, six months, postage included	1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each: additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly: every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVIII., No. 17. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, APRIL 27, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Price 10 cents. To be had at this office and of all newsdealers.

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 121,
For the Week ending April 27, 1878.

☞ Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

SCIENCE AND COMMERCE AS PEACEMAKERS.

There are two and only two great interests which, in the progress of mankind toward civilization, have proved themselves to be overwhelmingly on the side of peace, namely, Commerce and Science. And to the development of these we must look for the final suspension of warfare, if the reign of universal peace shall ever dawn upon earth. It is true that religion claims to be a peacemaker also—the great peacemaker; but history shows it to be rather a stirrer up of strife. It is not until men cease to regard religion as the first of human interests, not until they become comparatively indifferent toward it indeed, that they cease to fight about it.

The influence of commerce as a preventive of war is more direct and tangible. To the commercial mind the leading question touching any course of action is, Will it pay? And the experience of mankind is, on the whole, that, commercially considered, war does not pay. Particularly is this true when the commercial relations of the contestants are at all close. Besides, commerce makes for peace by multiplying channels of friendly intercourse, by removing national prejudices, and by increasing the mutual interdependence of nations.

The peace promoting influence of commerce can be clearly seen in the recent history of the relations of this country with England. We have had disputes in abundance, and, according to non-commercial standards, plenty of occasions for an appeal to arms. But our commercial relations have been so intimate and extensive that we could not afford to go to war; consequently our difficulties have been honorably settled by arbitration or other peaceful means.

It is equally clear that the commercial interests of England have been the chief restraining force in that country during the recent oriental trouble. Both the ruling class and the rabble have been eager for war; but the prudent, practical, commercial element has carried the day for peace. And we may set it down as an axiom in social science that as the commercial intercourse and mutual dependence of nations increase, their disposition to go to war with each other will decrease. With such nations the prosperity of the people outweighs dynastic pride or imperial ambition. The people say, "War will not pay: let us have none of it;" and more and more in the world the will of the people rules.

As the great ally and mainspring of commerce, science plays an important role as national peacemaker; but its chief influence comes through its service in making war more and more terrible and destructive, on the one hand, and, on the other, in making it less and less a matter of individual heroism and brute force. It is a common remark that the history of military art is simply the record of inventions for enabling men to kill each other with ever increasing ease and swiftness. And the latest inventions have been most marvelous in their capacity for killing. There is small chance for personal glory on the battlefield now; and every new invention only helps to reduce battles more and more to the level of the shambles. The question is, Will not this line of progress soon end in making war too horrible to be tolerated? It must be apparent before long that no end attainable through fighting can be worth the sacrifices necessary to gain it through or in spite of such destructive agencies.

Besides, may it not be possible for inventors to contrive engines of destruction, so awful in their scope and so irresistible in their power, that the mere assembling of masses of men for offensive purposes may be made too hazardous to be attempted?—engines by means of which a city or an army, however protected by fortifications, may be destroyed without possibility of escape?

We have seen of late years how one branch of warfare has been practically suspended by the progress of invention. In their desire to compete with the naval power of England the governments of Europe have for the past quarter century put forth their strongest efforts to bring the science of offensive and defensive naval construction to perfection; and England's counter efforts to maintain the supremacy of her fleet have called out the utmost energies of her inventors and builders. Yet the result seems to be to make a great naval battle no longer a possibility. During the Franco-German war the second best navy in the world could do nothing. During the war just ended the splendid fleet of Turkey, officered by Englishmen, has been little better than useless. And with all our joy at the termination of that conflict, we cannot repress a shadowy regret that no opportunity was offered to remove the uncertainty as to whether the English ships could have got out of the Sea of Marmora if any one had chosen to stop them. It might be worth a small war to have the status of iron clads definitely determined. As things stand their utility is wholly a matter of conjecture.

So much for invention in naval warfare. The torpedo has been the great peacemaker. And it is quite possible that the torpedo system may ultimately perform the same war restraining office on land. Surely science and ingenuity are capable of creating an aërial torpedo boat as efficient as the water torpedoes are. And then, who will dare go to war? Let us imagine an aërial torpedo carrier that could be navigated by electricity from the ground or from another air ship kept beyond the reach of destructive missiles; a deadly machine that could be made to hover over an attacking army or a beleaguered town and rain upon it explosive shells of the most destructive sort. Against a fleet of such engines, what city could stand, what fleet or army could gather for offensive purposes? All the usual machinery of war would be useless, and war as we understand it would be impossible. As the sea torpedo has made an end of naval battles, so the air torpedo would put a stop to battles on land. And just as, through increasing civilization, men are learning more and more to put their trust, not on personal prowess or elaborate armament, for the settlement of their personal disputes, but in courts of law, so nations must learn to submit their quarrels to international courts of arbitration. In perfecting firearms, science put an end to individual dueling. In like manner, by perfecting means of wholesale killing, science is likely to put an end to national dueling. The most efficient agent of the (unorganized) Universal Peace Society of the future will be he who shall invent the best aërial torpedo carrier.

THE UTILIZATION OF WASTE MATTERS.

The strict economy of Nature, which never allows a particle of matter to be either wasted or lost, is so manifest that it could scarcely have escaped the attention of man; and so, when circumstances compel him, it is not surprising to see him putting in practice the lesson she has taught him, and striving to put every scrap to the best account. In China, owing to the crowded state of the population, this economical husbanding of material has, of necessity, long been in vogue; and to such an extent is it carried that what would be considered strict economy in Europe or America, would there be regarded as absolute waste. The same causes have been slowly operating to bring about a similar state of things in Europe. Thousands of materials that were but a few years ago thrown away as utterly useless are now carefully saved and turned to some account either for purposes of luxury or necessity. Hosts of costly products of distant climes can now be procured at home, at an insignificant expense, from the most unpromising sources. For instance, Science has evoked the most delightful perfumes from the most offensive refuse, and extracted dyes of the most gorgeous hues from a most unlikely looking material—pitchy-black tar. Accidental discoveries, no less than active researches, are continually transforming some article comparatively worthless into something else that stands high in commercial estimation, and supplementary factories are gradually springing up to utilize the by-products of others. So numerous are the discoveries that something useless may be converted into something useful, and so rapidly does one follow in the wake of another that it is difficult to keep pace with them. Scarcely a scientific exchange reaches us that does not contain the announcement of some such fact, and the details of the process by which the result may be reached. Here, for example, before us, in the current number of the *Echo Industriel*, we have a description of the method by which the straw is extracted from manure heaps to be subsequently utilized (after cleaning and drying) as a cheap bedding for horses and cattle, packing for glass, crockery, etc., but more especially for making paper pulp, to which it is said to be peculiarly adapted; since, saturated with urine and allowed to ferment, ammonia is evolved, which aids in separating the fibers, and reduces the need of using stronger and costlier alkalies to a minimum. After extracting the straw the remaining manure is sold for the usual purposes. The simple machinery for doing all this is the invention of an American resident of Paris. Much of the false hair worn by the fair sex of Europe and America is derived from sources that would make the wearers stand aghast were they to learn the facts. From a late report on the commerce of Swatow (China) we learn that a large export trade in hair, gathered in the stalls of barbers, sprang up in 1873, during which year 141 piculs (18,800 pounds) worth 2,904 taels ($4,300), were shipped to Europe. In 1875 the exports of this refuse arose to 1,000 piculs, with a value of over $25,000, certainly a remarkable industry to be created at such a distant point to supply the demands of a caprice of fashion.

To chemistry modern perfumery is perhaps more indebted than any art that ministers to the luxury of life. It is commonly supposed that all floral essences are the product of distillation; nothing could be a greater mistake; nearly every perfume of the toilet bottle or sachet of the mouchoir case is the product of waste matters—some of them odorless, others most intensely nauseous and disgusting. "Many a fair maiden damps her brow with the "Extract of Millefleurs," innocent of the knowledge that its essential ingredient is derived from the drainage of the cow-house! The perfumed toilet soap is scented, and confectionery flavored, with oil of bitter almonds artificially prepared by the action of nitric acid on the fetid oil of gas-tar. The pure "fruit sirups" of some of the soda water venders are made from factitious oils that chemists have learned how to produce. Singularly enough, too, the latter are usually derived from substances of disgusting odor. The oil of pine-apples is obtained from a product of the action of putrid cheese on sugar, or by making a soap with butter and distilling it with alcohol and sulphuric acid. The peculiarly fetid substance called "fusel oil" serves as a base for several artificial flavors; thus, distilled with sulphuric acid and acetate of potash it gives oil of pears; with sulphuric acid and bichromate of potash the product is oil of apples. And so, too, by other means known to the chemist, refuse corks are made to yield essence of mulberries, tallow to put forth essence of melons, and the wood of the willow tree to part with oil of wintergreen indistinguishable from the genuine article." The fact, well known to the schoolboy, that by the action of sulphuric acid on starch, sawdust, woody fiber, etc., a sac-

charine substance called "glucose," or grape sugar, is produced, has not by any means been lost sight of in this country, notwithstanding the low price of cane sugar. Extensive works for the manufacture of this article are located in one of the largest cities of the western part of the State, and almost every day one or two car loads arrive, occasionally consigned to Europe, but oftener to the various brewers of the city and vicinity, and to extensive dealers in molasses. All these matters show a direct application of science to an industrial purpose, and imply a knowledge of the deepest investigation into organic chemistry.

One of the most singular discoveries in the history of agricultural chemistry is due wholly to the French. Sheep draw from the land on which they graze a large quantity of potash, which is eventually excreted from the skin along with the sweat. It was shown by Chevreul that this peculiar potash compound ("suint") forms at least one third of the weight of raw merino wool; while it constitutes about 15 per cent of the weight of the fresh fleece. As it is easy to extract the "suint" by mere immersion in water, the wool manufacturers can readily produce more or less concentrated solutions, from which the potash may be recovered by appropriate treatment. The development of this new industry is principally due to MM. Maumné and Rogelet, whose process, in operation at most of the great seats of wool manufacture, is very simple. They evaporate the solutions to dryness, and place the residuum in retorts, and distill it very much the same as coal is distilled at gas works. The result is that while much gas is evolved which can be used for lighting the factory, and much ammonia is expelled which can be collected and used in many ways, there remains a product consisting of carbonate, sulphate, and chloride of potassium. These salts are separated by the usual method and pass into commerce. While on the subject of animal refuse, we may refer to the manner in which certain dead animals are utilized in France. Every portion of a dead dog, for instance, is converted to some use; it is boiled down for the fat, the skin is sold to glovers, and the bones go to make "superphosphate." In Paris the carcass of a horse is worth more than elsewhere, inasmuch as the working classes eat the best portions of the flesh. The hair is a well-known refuse used by the upholsterer; the hide goes to the tanner to make thick leather for bank ledgers, etc.; the intestines make coarse gut-strings for wheel bands and lathes; the fat, which from a well-conditioned horse amounts to 60 lbs., finds a ready market; the hoofs are used either by turners or makers of Prussian blue, and the bones go to manufacturers of ivory black and to turners. Even the putrid flesh is allowed to breed maggots, which are sold as food to fatten fowls. The final residue is used by rat catchers to trap their prey, and the skin of the captured rat finds a ready sale among furriers on account of its delicate fur. A statement that has frequently gone the rounds of the papers to the effect that most of the "kid" gloves of commerce are made from the skin of this rodent is probably untrue, since its small size would preclude its use for anything but gloves for children.

The great meat-packing establishments of the West afford examples of the extreme refinement to which the utilization of by-products may be carried. Not a scrap of the slaughtered animal is wasted. Every portion fit for food (even to the heart and liver) is pickled and packed, and most, if not all, of it exported to Europe. The fat, hoofs, horns, hides, tails, hair, and bones find a ready sale in this market, for various purposes in the industrial arts; and the final products usually reach us in the form of dried blood and bone-black, for the use of the sugar refiner and the agriculturist.

Until within comparatively a recent period it had become a serious question as to what use should be made of the slag which is produced in such quantities during the smelting of iron ore; human ingenuity at length solved the problem, and produced from this intractable material a white, flocculent substance known as "mineral wool," which at once found numerous applications in the arts. Within the last few years no industry, perhaps, has made greater strides than that of paper making, both as regards the materials of its manufacture and the applications of the product. Paper wheels for railway cars, paper chimney-pots for dwelling houses, and paper plates and teacups for the temporary use of travelers, must suffice as illustrations.

Of course it would be impossible within the limits of so short an article to refer to any more than a few of the more prominent examples of the use of refuse. We have intentionally omitted very many; but the few that we have given will serve the purpose we have in view of showing to how great an extent civilization is daily adding to the useful products of the world, both by economizing its resources and calling forth new ones by the aid of chemistry.

"CONVICT COMPETITION."

Our workingmen readers are invited to consider the following hypothetical case, bearing on the convict labor question—a problem which has recently been made the subject of sundry exceedingly sympathetic diatribes by those solicitous friends of workingmen, the politicians who compose the Legislature of this misgoverned State. The reader will imagine himself in the disagreeable predicament of being assaulted, badly injured, and robbed by a burglar who is subsequently captured, convicted, and sent to prison for a long term. The victim after a long and costly illness finds his savings swept away, and himself maimed and unable to perform his previous amount of work. Still by owning his house he is able to live and support his family. In due time the yearly tax on his house falls due, and in looking over the items of taxation he finds one for "maintenance of prisons and penitentiaries." He goes to a political friend—a legislator—for explanation, and is informed that the average cost of supporting each convict is in the neighborhood of $150 a year, and the people "of course" pay it.

"And what do the convicts do in return?" he asks.

"Nothing. They are not permitted to work at any remunerative industry."

"But while honest men outside are doing severe labor—laying pavements, blasting rocks, erecting buildings, all kinds of hard physical work—how are these scamps employed?

"Well, they eat, and recline in their cells, and read tracts and other interesting literature supplied by philanthropic visitors. Their food is much better than the average workingman has who labors for a dollar a day, and its forthcoming is not dependent on the chances of employment. Oh, if the State is going to shut them up, of course it's got to feed, house, clothe them, provide medical attendance, brace up their moral characters, and turn them over to the Prison Association when they go out, to be started anew in life, with a new suit of clothes and money in their pocket."

"Nobody takes any such interest in my welfare, and I have committed no crime. On the contrary, it taxes all my energies to obtain house, food, and clothing by unremitting labor, which in these times is even difficult to procure. My capabilities are greatly reduced by an injury inflicted by one of these convicts; yet not only is he freely given as much and more, practically, than I am able to earn, but I am compelled to contribute from my scanty means for his support. Why cannot these men be put to useful labor? Why should they not sweeps the streets, as in Cuba and Spain, or work in the dockyards and on public improvements, as is done in France? Why don't you find some redress for this unjust condition of affairs?"

"Because my constituents won't vote for me again if I favor any measure which they imagine affects their pockets adversely. If we employ convicts at railroad building, on public improvements, and other useful outside work, it is true that the prisons will become self-supporting and remunerative institutions, and that instead of your taxes being increased the same would be reduced through their gains. But 6,000 convicts may compete with as many workingmen, and to conciliate these last we think it best to go on and support the convicts."

"In other words, for the sake of political capital and to favor the notions of a few selfish individuals who have no respect for the rights of others, honest men of all classes are to deprive themselves and their families in order to maintain 6,000 scoundrels in idleness?"

"Precisely."

And with this our friend picks up his crutch and hobbles away, wondering, morality aside, whose position is the most unenviable, his or that of the miscreant who injured him. It is fortunate, however, that in this State, through Superintendent Pillsbury's admirable management of the reformatories, the convict labor problem is being removed from discussion and danger of a wrong solution through legislative buncombe or the intrigues of malcontent workingmen. Some of the largest institutions are already self-supporting, and a few are paying the commonwealth a handsome revenue, through the convicts having been quietly set about remunerative work, without regard to the advice of either politicians or demagogues.

STERILIZATION BY LIGHT.

It is hardly necessary to refer to the very highly beneficial influence exerted by light upon health, whether in the animal or vegetable world. Deprivation of sunshine works a retardation, and in many instances stoppage of natural processes. Those workmen are the least healthy who labor in cellars and dark rooms; and it is well known, on the other hand, that light, in greater or less degree, is not without direct influence upon the nervous system. What the mechanical action of light is, however, upon organisms is a problem still unsolved, but that a solution is being approached may be safely predicated upon recent important discoveries. Of these one of the most remarkable is that made by Dr. Downes and Mr. Blunt, and lately described by them in a paper read before the Royal Society, this discovery being that solutions otherwise fertile may be completely and permanently sterilized by the action of light alone.

The fact has been very simply demonstrated by filling test tubes with Pasteur's solution, placing all under precisely the same conditions, and then protecting some from the light by a sheet lead casing. In the protected tubes, the liquid in a few days became turbid and filled with bacteria; the solution in the exposed tubes remained perfectly clear, and no organisms were perceptible under the microscope. This experiment was repeated numerous times, always with like results. The greater the amount of sunshine the greater the sterilizing effect, and a few days of full sunshine were sufficient to prevent entirely the development of the organisms. Tests were instituted to determine if the action of the light resided in the liquid yielding negative results. It was found that light was directly capable of destroying bacteria; as, if a tube was protected from subsequent contamination, it remained permanently sterile after exposure to sunlight, even though subsequently darkened. By other careful experiments it was determined that less than two hours of direct sunlight is insufficient to prevent the development of bacteria in inoculated solutions. The putrefactive tendency of warmth does not override the preservative quality of light; and the experimenters found that, with a full amount of sunlight, tubes could be preserved from day to day as readily in hot weather as in cold.

The action of light was not confined to Pasteur's solution, as urine could be preserved in the same way. It is curious to note that the germicidal influence does not extend to the spores of the yeast plant, and that the light does not retard the growth of the same, there even appearing to be a kind of antagonism between the bacterial and fungoid growths. A series of experiments was instituted to determine the effect of different colored light on the solutions, colored glass screens being interposed. It was found that bacteria appeared first in those protected by yellow, and in those almost as soon as when cased in red; next in the red; while those in the blue remained permanently clear. It is difficult to draw any deduction safely from this. The *Lancet* thinks that it points to the actinic rays of the spectrum as the active sterilizing agents, a view in which we cannot agree, inasmuch as blue glass does not transmit the pure blue spectral ray or even the actinic rays only, but allows rays of all colors to pass, with some diminished in intensity. It acts, therefore, merely as a screen to diminish the power of the light, and the fact that it does so transmit only modified sunlight is indicated by the sterilization produced. Still it is difficult to explain the presence of bacteria under the yellow and red lights, and hence our belief that the correct deduction from this experiment is yet to be made.

One of the most remarkable discoveries of this highly important chain was that in the absence of an atmosphere around the tubes, light exercised no sterilizing influence whatever. Specimens of the same urine, insolated to the same degree, but preserved in vacuo, became turbid from bacteria as rapidly as others incased in lead. The investigators suggest that "many of the related conditions of organic beings may derive new meanings from the facts now ascertained, and point out the apparent antagonism in origin and effect between the colored chlorophyl, which owes its origin to light and is deoxidizing in its action, and the colorless protoplasm which it shields, and to which apparently, at least in some of its forms, the solar rays are not only non-essential, but devitalizing and injurious."

These experiments may be regarded as all the more striking when brought into comparison with some of M. Pasteur's later discoveries. Not long ago he held a discussion with M. Boussingault on the question of the influence of solar radiation, the latter holding that, if solar radiation should disappear, life would be impossible. Pasteur, on the other hand, maintained that it would continue in certain inferior plants, and occasion the most complete organic growths; and he adduced as an illustration the life of the *Mycoderma aceti*, which may take place in darkness on a liquid composed of alcohol, acetic acid, and mineral phosphates. It will be observed that Pasteur's demonstrations that oxygen and light are not necessary to life are remarkably corroborated in these latest researches of the English biologists. Not only may organisms live in darkness, but light becomes an absolute source of destruction to them; not only may they exist without oxygen, but a vacuum forms for them an efficient protection—two conclusions as flatly contradictory as possible to preconceived notions regarding the omnipresent necessity for oxygen and light on the part of all organic nature.

A DANGEROUS ITEM.

We do not remember in what journal we first saw the following extract as an *original* item; but, since it has recently been copied without comment by several cotemporaries, attention should be directed to it. The article states that:

"A poison of any conceivable description and degree of potency, which has been intentionally or accidentally swallowed, may be rendered almost instantly harmless by simply swallowing two gills of sweet oil. An individual with a very strong constitution should take nearly twice this quantity. This oil will most positively neutralize every form of vegetable, animal, or mineral poison with which physicians and chemists are acquainted."

The idea that sweet oil will neutralize such poisons as prussic acid, nicotine, strychnine, curare, and a host of others less speedy in their action, is almost too absurd to demand refutation. In some cases, when taken into the stomach in large quantities, it may serve to involve acrid and poisonous substances and mitigate their action, until the arrival of a physician with specifics shall relieve the patient from danger; but it is not to be used in *all* cases, for its administration, for instance, immediately after the swallowing of a corrosive mineral acid, such as oil of vitriol, would be followed by most fearful results.

As the great multitude of poisons known to the physician and chemist are classified according to their varied mode of action on the animal economy, it is evident that the method of treatment in cases of poisoning must likewise vary. There can be no one specific for all.

It is to be hoped that no one will be simple enough to try this antidote; for if he does, the absurd person who penned the quoted statement may have a human life to answer for.

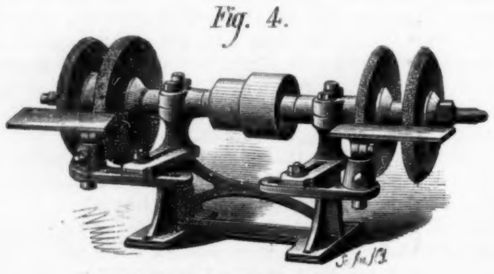
THE *Société d'Hygiene* of Paris is making arrangements to establish in the cities and towns of France chemical laboratories for the purpose of examining articles of food and detecting adulterations or unhealthful constituents. In England the value of public analysts has long since been satisfactorily demonstrated.

[*Continued from first page.*]

placed in trays and exposed to a uniform and peculiar atmosphere, indicated by a hygrometer, and a certain temperature varying slightly above and below 120°; the pressing room (Fig. 2, page 255), where there are hydraulic pumps and presses of great power, a great variety of moulds, and mechanical appliances for the manipulation of the wheels; a testing room (Fig. 3, page 255), where each wheel is tested before it leaves the manufactory; and a machine shop, for the construction of new machinery and repairs to the machinery on the premises.

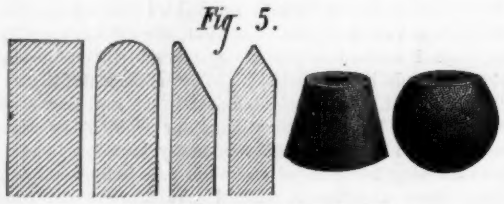
The process of making emery wheels is apparently a very simple one, but great experience and good judgment are necessary in the selection of suitable materials and the mixing, tempering, and pressing of the same. When a wheel is ordered for some specific purpose, the manufacturers' formula for such a wheel is sent to those in charge of the different departments. This formula states the kind and proportion of materials to be used, the pressure and heat to be applied, etc. The first process is the mixing and drying, as already referred to; the second, the pressing. After the composition and adhesive matter have been thoroughly worked and prepared, the mixture is placed in strong cylindrical or other shaped iron moulds and subjected to an enormous pressure. The hydraulic press, represented on the right of the engraving, Fig. 2, has a cylinder 5¼ inches thick, made out of gun metal; the ram is 19 inches in diameter; the platen 4 feet square, and the diameter of the Bessemer steel columns is 3½ inches. This press is operated by double force pumps, and is capable of exerting an immense hydrostatic pressure. Attached to this machine is a mercurial gauge which will indicate 1,000 tons pressure. Smaller hydraulic presses are used for lighter work. The pressure on the wheels is applied at top and bottom, and the plates between which the wheel is pressed are heated by steam to certain temperatures. After the wheel has been thus moulded and pressed, the mould is taken to a smaller hydraulic press, which removes the wheel from the mould. It is then left to cool and harden, after which it is turned and "trued up" in an ordinary lathe, the turning being effected by the use of diamond turning tools. It is then ready for testing, which is done by putting the wheel on an arbor and driving it at a high speed, about 10,000 feet (surface speed) per minute. To prevent accident in case the wheel should burst, owing to the great centrifugal force, the wheel and its arbor are inclosed within a strong wooden guard or box, as seen in Fig. 3. Should the wheel stand this test it is considered safe for use. Emery wheels are made at the works of the above-named company, of all sizes and shapes. It is claimed that a wheel of this description, 30 inches in diameter and 5 inches thick, will wear down nearly to the spindle, and will do just as much work as when large if speeded up. Hence the importance of using cone pulleys on the spindles of emery wheels. Small wheels, ½ inch in diameter and 1/16 inch thick, are made for dental purposes. Fig. 4 represents an emery wheel machine, on the arbor of which from two to six wheels can be placed and operated at one time, and Fig. 5 shows some of the different forms in which the wheels can be shaped. The emery wheels made at these works are strong, durable, and of very excellent quality. Being made under a hydraulic pressure combined with heat, we are informed that perfect regularity in their hardness is obtained. There is no clogging or gumming, and the hardest metal when applied to the corners is cut rapidly away without any perceptible wear of the wheel.

Fig. 4.



THE LEHIGH EMERY WHEELS.

Fig. 5.



FORMS OF EMERY WHEELS.

THE CULTURE OF HOUSE PLANTS.

At this season of the year, a little care bestowed upon the treatment of house plants is better repaid in the future growth of the plants than at any other time. The soil for potting plants must be light. It may be lightened by mixing it with coarse sand such as builders use. The soil should not be pressed tightly about the plant roots, nor should the pot be quite filled with mould. There should always be drainage provided. For pots it is sufficient to well cover the bottom of the pot with small pieces of broken earthenware. But if boxes are used a layer an inch and a half deep of coarse cinders is excellent. This drainage is necessary to prevent the roots from rotting, and it follows that plants should never be watered from the flower pot saucers. But very little water is necessary at this time of year, nor should it be perceptibly warmed. Slips or cuttings will start best in unusually dry soil if the temperature is below 60° Fah., but if planted in coarse sand a liberal supply of water is necessary.

A very common error is to choose old wood for slips or cuttings, whereas the young green branches are the best. They should be planted deeply, and the surface of the soil must be kept loose. In watering, wet the soil in the neighborhood of, but not close to, the cutting. Carnations and pinks are best obtained by layering; that is, the shoots are cut half or three quarters through, and bent so that the part cut may be covered about a half inch in the soil. In about three weeks the part cut will have thrown out roots, when the cutting may be removed from the parent plant and potted by itself. Geranium slips are best obtained by cutting arms of young wood three quarters of the way through at a distance of about two inches from the end of the shoot, and then allowing the partly severed slip to stand about a week or eight days on the parent plant before entirely severing it. Running plants are best propagated by pinning the arms down to the surface of the soil; this will cause them to take root as they spread. To cause plants to grow bushy, pinch the eyes out of the ends of the longest branches, which will then throw out side shoots, and in this way a plant may be caused to grow to almost any required shape. If plants are infested with insects they may be effectually freed as follows: Place them upon a table or platform, on which there are two or three inches of sand, and cover them with a vessel of any kind, or place over them a cloth so arranged as to cover without damaging them. Beneath the vessel or cover insert some burning tobacco, and let it remain for ten or fifteen minutes. This is a much better plan than using tobacco water, because the smoke will permeate between the leaves, where it would be difficult to get the tobacco water; but if tobacco water is used, it should be syringed beneath the leaves in all directions. If the soil is impregnated with insects, as is very often the case from the use of fertilizers, the very best remedy is to let the soil get dry, and then cover it with chimney soot to a depth of about ¼ inch; then apply water liberally. This will kill the insects without injuring the plants. Insects in the fertilizer are very common and destructive for plants, and can only be guarded against with certainty by pouring boiling water on the soil after well mixing the fertilizer in it. To prevent the destruction of seed by insects, it may be mixed, before sowing, with either powdered sulphur or soot, the latter being preferable.

To cause a plant to bloom, allow it to become pot bound; that is, let it remain in the pot until the roots have become matted in the pot, and as soon as it has done blooming repot it in a larger pot, taking care not to disturb the roots. In order to facilitate this give the plant a little water; place the hand over the surface of the soil, with the fingers spread out and the stem of the plant between the fingers; turn the pot upside down and tap its edge against something solid, and the plant and mould will come unbroken from the pot. Place the plant in the middle of the new and larger pot, and fill in all around it with rich mould.

Plants raised in the house for subsequent planting in the garden should be placed out of doors in the middle of the day during warm weather, so that they will become gradually accustomed to the change of temperature and not wilt when planted out. They should be planted out in a dry soil and in dry weather, or just before a rain shower.

Steam Launch Performances.

A correspondent writing from Port Royal, S. C., says: "It may be of interest to your readers to know the work performed by a little launch here. Length of boat, 30 feet; width of boat, 6 feet 9 inches; draught of water, 2 feet 6 inches forward, 3 feet 4 inches aft. One vertical engine and boiler on the same foundation (a flat cast iron plate); engine, 8 x 8 inch; pressure of steam, 40 pounds; revolutions, 220 per minute; screw, 3 feet diameter, 42 inch pitch; speed, 8·5 miles per hour. The engine has a piston valve. We exhaust into the stack for draught. With 60 pounds of steam we can make 9½ miles per hour."

Manufacture of Portland Cement.

At a recent meeting of the Liverpool Engineering Society, Mr. Wilkinson Squire described the process of making Portland cement, as practiced at the works of Messrs. Peters, on the Medway, which in brief is as follows: After being excavated close at hand the gray chalk, of which this cement is chiefly composed, is conveyed by a tramway to the mixing pans, where after being mixed with water and one fourth its weight of clay, it is thoroughly stirred and harrowed, and then run off into large tanks called "backs," where it remains for about 3 weeks to settle. At the end of this time the water is run off very quickly by an ingenious process, and the sediment, technically known as "storry," removed to an adjacent drying house, where it is thoroughly dried by the action of heat, and then passed to the kilns to be calcined, and from thence to mills to be ground to an extremely fine powder by large and powerful millstones; the usual test demanded by engineers being that, on being passed through a fifty wire gauge sieve, the residuum should not exceed ten per cent. On leaving the mills, all that remains to be done is the packing and dispatch of the cement.

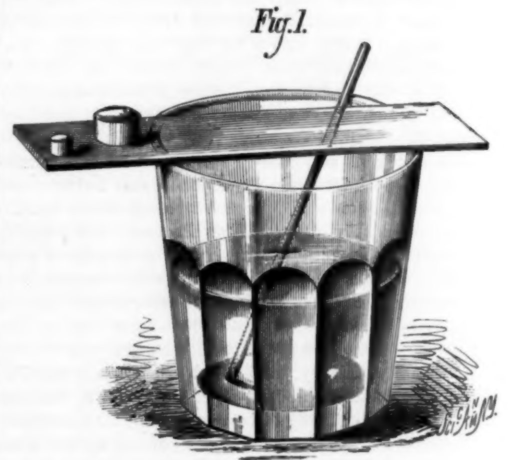
A WATER LENS MICROSCOPE.

BY GEO. M. HOPKINS.

The first microscope in existence consisted of a drop of water. Water lenses as formerly used were unstable and tremulous, and almost if not quite worthless. This difficulty may be overcome, and the drop of water may be rendered available as a microscope lens by confining it in a cell consisting of a short tube having a glass bottom.

Fig. 1 represents the simplest and cheapest of all microscopes. It consists of a thin piece of glass, having attached to it one or two short paper tubes, which are coated with black sealing wax, and cemented to the glass with the same material.

Fig. 1.



SIMPLE WATER LENS MICROSCOPE.

By aid of the small stick water is placed, drop by drop, in the cells until the lenses acquire the desired convexity. Objects held below the glass will be more or less magnified, according to the diameter and convexity of the drop.

An easily made and convenient stand for the water lens is shown in Fig. 2, and Fig. 3 is a vertical section of the lens, showing the screw for adjusting the convexity of the drop.

The stand is made of wood. The sleeve that supports the table slides freely upon the vertical standard. A wire having a milled head, by which it may be turned, passes through the upper end of the standard, and has wound upon it a strong silk thread, one end of which is tied to a pin projecting from the table supporting sleeve. An elastic rubber band is attached to the lower end of the sleeve, and to a pin projecting from the standard near the base, to draw the table downward. By this device the focus may be nicely adjusted.

Fig. 2.

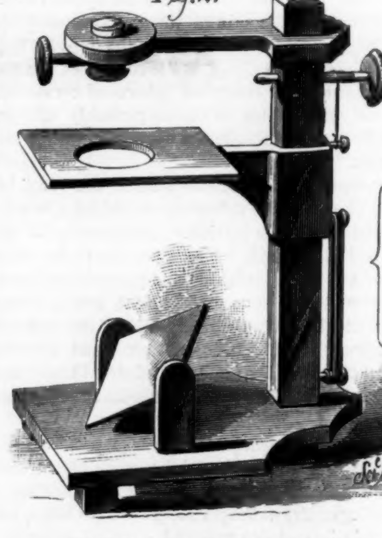
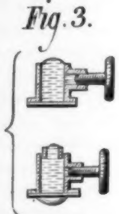


Fig. 3.



WATER LENS MICROSCOPE COMPLETE.

Two standards project from the bed piece for receiving the corners of a rectangular piece of silvered glass which forms the reflector.

The best form of water cell consists of a brass tube about ⅜ inch long and ⅛ to 3/16 inch internal diameter, having in one side a screw for displacing the water to render the lens more or less convex. A thin piece of glass is cemented to the lower end of the tube, and the inside of the tube is blackened.

Several bushings may be fitted to the upper end of the tube to reduce the diameter of the drop, and thus increase the magnifying power of the lens.

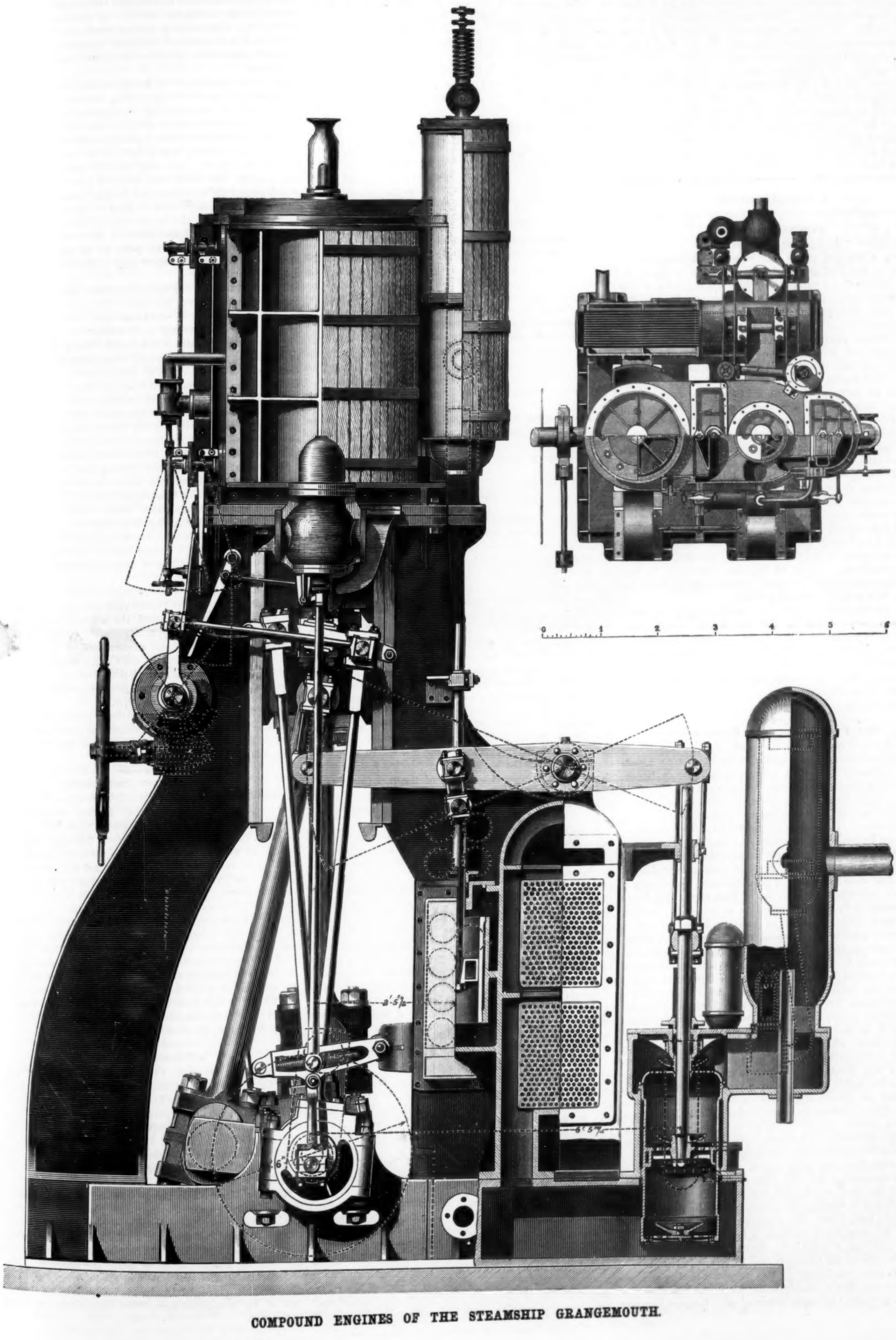
Water containing animalcula may be placed on the under surface of the glass, and the lens may be focused by turning the adjusting screw. The lens may also be adjusted to magnify objects placed on the movable table.

If air bubbles form on the upper surface of the glass they may be readily displaced by means of a cambric needle.

AT the recent annual meeting of the American Microscopical Society of the city of New York the following officers were elected for the ensuing year: President, John B. Rich, M. D.; Vice President, Wm. H. Atkinson, M. D.; Secretary, O. G. Mason; Treasurer, T. d'Oremieulx; Curator, John Frey.

COMPOUND MARINE ENGINES.

The accompanying engravings illustrate the compound engines of the English steamship Grangemouth, plying between the port of the same name, Leith, Rotterdam, and Amsterdam. The vessel is 190 feet long, keel measurement, 27 feet beam, and 14 feet 2 inches depth, moulded; and her displacement is 1,124 tons. The dimensions of the engines are as follows: Diameter of cylinders, 24 inches and 43 inches; length of stroke, 42 inches; nominal horse power, 125; condensing surface, 1,000 square feet; load on safety valves, 80 pounds per square inch. On trial the following results were obtained: Steam pressure, 79½ pounds per square inch; revolutions per minute, 85; speed of piston, 595 feet per minute; vacuum, 24·5 inches; indicated horse power, 766·3; speed in knots, against tide, 10·5. There are two tubu-



COMPOUND ENGINES OF THE STEAMSHIP GRANGEMOUTH.

lar boilers, having a total heating surface of 1,882 square feet, with a total furnace grate area of 64·4 square feet. The engines are provided with a Weir's patent feed heater, shown fixed to the side of the high pressure cylinder. The feed water from the hot well is pumped into the top of this vessel, and descends in the form of spray over a series of trays in the interior, mingling at the same time with a jet of steam taken from the receiver. This raises the temperature to upwards of 250°. It is then continuously drawn off at about that temperature, and forced into the boilers. The boilers are fitted with Cockburn's patent safety valves, loaded with direct springs. The *Engineer*, from which we obtain these particulars, states that the Grangemouth's engines have more power than is needed for the requirements of the trade in which she is engaged, and that her performance during the time she has been on her station has been highly satisfactory. On several voyages her engines have maintained an average speed of 79·5 revolutions per minute from port to port, with a very small consumption of coals.

Communications.

Treatment of Ores.

To the Editor of the Scientific American:

Being a practical quartz mill man, my attention was attracted by the leading editorial in your issue of March 23. Your opinion that a process for a finer comminution of ores is desirable would lack universal concurrence for two reasons: First, after passing through a 50 or 60 mesh screen, the ore particles, as a rule, conceal but little metal. A reason for this is that quartz is more tenacious than the mineral it contains, and in breaking or crushing ore the fracture is naturally through the richest portions. In support of this is a fact well known to many, that almost always the coarsest sand in the tailings (when cleaned as well as possible from particles of quicksilver and finer portions of tailings) will assay far less than the average tailings. If tailings from the Consolidated Virginia or California ores (they are all crushed coarse and ground), after running over the blankets, are discharged into a V box, which allows the escape of one half through the bottom and the other half over the top, the latter will assay about 50 per cent higher than the coarser half.

Secondly, ore can be made extremely fine in good pans in proper shape, time only being required; or by raising the muller just enough not to grind, we have the condition you suggest, *i. e.*, forcing the pulp through the quicksilver. A large percentage of the pans of to-day, however, do not fill these conditions, because of improper currents. A pan should generate a spirally annular current, passing under the muller with proper force and volume.

The principle that employs the stamp and pan for amalgamation purposes may be radically wrong, but he who thinks to supplant them by a better will find it a great undertaking; yet the reward would not be wanting, for there is no class of people who desire more to have the very best, or who take better to genuine improvements, than the mining men of the Pacific coast. M. P. B.

Oakland, Cal.

The Polariscope as a Photometer.

To the Editor of the Scientific American:

In my communication published in the SCIENTIFIC AMERICAN of March 23, page 186, I forgot to mention an important advantage possessed by my arrangement, and which is not shared by that of Herr Merz, described in the issue of March 16, page 163, in which the reflectors are all placed in a fixed position. The advantage referred to is that my apparatus can be used as a photometer, by attaching a graduated scale so as to measure the angle under which the analyzer is turned round. All who are familiar with polarized light know that when the planes of polarization of polarizer and analyzer coincide, there is no loss of light except that due to the absorption by ordinary reflection or refraction; further, that when either polarizer or analyzer is turned round, the light is gradually obliterated until the planes of polarization make an angle of 90°, when the minimum amount of light is reached. It is therefore evident that the number of degrees required to make two sources of light equal gives a comparative measurement of their relative intensities. Theory teaches, however, that this angle itself gives only an approximate estimate, and that the correct measure is the square of the sine of the angle. This has been confirmed by experiment, which is easily done when such a polariscope is used in conjunction with the ordinary means of photometry. I will illustrate this with an example: Suppose we have as two lights the flames of a kerosene lamp and of a standard wax candle, and that we have to turn the analyzer 30° in order to reduce the kerosene flame to the intensity of the wax candle. As the sine of 30° = ½, and its square ¼, it would prove that the kerosene flame is four times brighter, and therefore equal to four standard wax candles.

Another item has to be added, namely, that Zöllner of Berlin has applied this very same method to the classification of the stars, substituting, for the rough estimate thus far followed in dividing them into stars of the first, second, and third magnitudes, etc., a regular astro-photometric process. He uses for a standard a lamp the light of which shines through a small hole, throws its light by reflection into the tube of the telescope, and its image in the focus of the eye-piece, employing for this purpose a similar arrangement to that used to illuminate the fine cross threads serving for measurement by night observations. Suppose him now to compare two stars, say Sirius and Capella, and that he has to turn the analyzer through 23° to reduce the light of Sirius, and 10° to reduce that of Capella to the same intensity as that of the lamp, a rough estimate would give the relative intensity of these stars as 23 : 10 or, nearly, 7 : 3, showing that Sirius gives about 2⅓ times more light than Capella. The more correct estimate gives for the sines of 23° and 10° respectively 0·0389 and 0·0174, of which the squares are 0·15138 and 0·03027; of these numbers the first is nearly five times greater than the last, proving that if correctly calculated the light of Sirius is equal to five times that of Capella. This agrees better with estimates made before, though with less perfect means. Some of the results obtained by Zöllner by the use of this polariscope-photometer, are as follows:

COMPARATIVE LUMINOSITY OF THE MEMBERS OF OUR PLANETARY SYSTEM.

Sun is to full moon as	613,000 : 1
" " Mars as	7,000,000,000 : 1
" " Jupiter as	5,500,000,000 : 1
" " Saturn as	131,000,000,000 : 1
" " Uranus as	8,000,000,000,000 : 1
" " Neptune as	80,000,000,000,000 : 1

COMPARATIVE LUMINOSITY OF SOME STARS.

Capella and Sirius are as	1 : 5·0
" " Vega "	1 : 1·2
" " Betelgeuse	1 : 0·5
" " Regulus	1 : 0·4
" " Pollux	1 : 0·3

COMPARATIVE LUMINOSITY OF STARS AND PLANETS.

Capella and Venus are as	1 : 48·0
" Mars "	1 : 7
" Jupiter "	1 : 10
" Saturn "	1 : 0·4
" Uranus "	1 + 0·0066
" Neptune "	1 : 0·0007

These data will form important records for the future, as it is well known that continual and sometimes very great changes take place in the amount of light developed or reflected by the heavenly bodies.

P. H. VANDER WEYDE.

PLANT MIND.

IV.

IMMOBILITY VERSUS ACTIVITY.

Careless observers accept without question the idea of immobility, in connection with the life and being of plants, considering them as only intended to adorn the surface of the earth, and please the eye with their beauty, or as good for food and medicine; yet due consideration of the organization and phenomena of plant life goes far to contradict this general impression. Attentive observers and profound thinkers have drawn different conclusions. We quote, to begin with, from the "Cosmos" of the illustrious Alex. von Humboldt: "If nature had endowed us with microscopic powers of vision, and the integuments of plants had been rendered perfectly transparent to our eyes, the vegetable world would present a very different aspect from the apparent immobility and repose in which it is now manifested to our senses." Charles Darwin also, in his "Structure and Distribution of Coral Reefs," remarks that our forests do not conceal so many animals as the low weedy regions of the ocean, where the sea weed rooted to the bottom of the shoals, and the severed branches of the fuci (sea wrack), loosened by the force of the waves and currents, and swimming free, unfold their delicate foliage, upborne by air-cells.

Baron Charles von Reichenbach, in his valuable work on the "Dynamics of Magnetism," relates some interesting experiments on living organic structures, demonstrating that special manifestations of intense vital activity occur in plants. For instance, coils of stout wire were laid over a *Calla Æthiopica*, a *Pelargonium moschatum*, and an *Aloë depressa*. The wire became immediately hot in the hand of the holder, and at the same time the point of the wire diffused cold wind. The *Calla* manifested the greatest strength, the *Aloë* the least, while the *Pelargonium moschatum* always kept the medium, and so it seemed likely that the measure of the strength increases in equal degrees with the rapidity of the growth. The *Calla* is quick growing, while the *Aloë* is slow. M. Reichenbach also discovered that entire trees produced a total impression of coolness; and plants in pots were mostly warm on the stem, cool in the flowers. Trees were cold near the upper end, but warm near the ground.

The vital activity of plants consists chiefly of processes which are not visible to the unassisted eye, such as growth and assimilation, or vegetable glandulation, by which are separated from the sap or vegetable blood, mucilage, starch, and sugar, for the sustenance of bulbs and buds. An exception, however, may be found in their secretion of honey, in the *nectarium* or honey gland, which is of great importance in the vegetable economy. In 1694, Tournefort recognized its existence in the passion flower and some other plants; and Vaillant, in 1718, regarded it as a part depending on the petals. Its name is due to Linnæus, derived from *nectar*, the fabled drink of the gods. In many flowers the *nectarium* is shaped like a spur or horn; in others, forms a part of the corolla, lying within the substance of the petals (lily); again, in a series or row within the petals, yet unconnected with their substance, often resembling a cup, as in *narcissus;* situated upon, or making a part of the calyx; seated upon the anthers, or tops of the stamina; placed upon the filaments; upon the seed bud, attached to the common receptacle; with others of so singular a construction, they do not properly fall under any of the above descriptions. In the *Pelargonium*, or African geranium, the nectary is a tube running down one side of the flower stalk. In this honey cup the secretion is exposed to the open air previously to its absorption into the vegetable vessels. A French philosopher has endeavored to show that the oxygen, or base of vital air, is the constituent principle of our power of sensibility. The sugar-making process carried on in vegetable vessels is a great source of life to all organized beings, and cannot be made from aërial matter without the assistance of vegetation

To return, this process of honey making results in an accumulation of carbon or sugar in the nutritive organs of the plant, which is consumed by its reproductive ones. The *Cacalia suaveolens* produces honey in such abundance that it may sometimes be smelled at a great distance from the plant. Dr. Darwin remarked that he had at one time counted on one of these plants, "not only bees of various kinds without number, but above two hundred painted butterflies, which gave it the appearance of having so many additional flowers." This honey forms the food of the male and female parts of plants, and the nectary begins and ceases its production with the birth and death of those *animated beings*, the *stamens* and *pistils*, or the parts of the plants in which seems to be concentrated what may be termed the *individuality* of plant life.

The similitudes of vegetable and animal anatomy will occupy our attention from this point. R. C. K.

Thomas C. Connally.

In the notice of deaths in the Patent Office at Washington, omission was made of one which creates a profound impression among a large circle of acquaintances. Thomas C. Connally was long connected with the Patent Office as Assistant Examiner, and filled the position with credit to himself and satisfaction to the government. He was a man of great purity of character, much personal worth, kind, generous, sympathetic. An acquaintance of many years enables me to bear this slight tribute to his memory.

Mr. Connally was formerly a journalist, and the writer first became acquainted with him as editor of the *Evening Telegraph*, published in Washington 1852–3. He was highly esteemed by his cotemporaries, Messrs. Gales and Seaton of the old *National Intelligencer*, Blair and Rives of the *Globe*, and Gideon of the *Republic*. He was an honorable laborer in the field of Washington journalism, and contributed not a little to the enviable position of metropolitan political papers of that day.

Mr. Connally never wholly relinquished his interest in the press, and during the last Presidential campaign contributed the power of his pen toward the success of his party. He was fond of literary and scientific work, devoting much of his leisure to the advancement of their claims. Several gentleman residing at the Capitol organized, a few years since, a scientific association, holding bi-monthly meetings, to discuss matters of general scientific interest. Mr. Connally was an active member.

It is always painful to record the departure of friends, but when men of so much usefulness and great personal excellence die, we feel that no common loss has befallen the community. Peace to his memory. D.

Accidental Fish Propagation.

About two years ago the Missouri and upper Mississippi rivers were stocked with salmon. During the last season salmon in various stages of development up to full size were caught in these rivers; and the frequent finding of large fish has caused no little astonishment to those who regard the stocking of two years ago as the original beginning of the species in the locality, the matter becoming a topic of newspaper comment. A correspondent, residing at Oregon, Mo., recalls to our recollection the fact that, some eight or nine years ago, a fish train, bound for California, under the auspices of the Fish Commission, was wrecked on the Elkhorn, near the confluence of that river with the Platte, in Nebraska. Our correspondent happened to be a witness of this accident, and confirms the statement published at the time, that millions of small fish and fertilized eggs were in this way lost (as it was thought) in the Elkhorn. This appears to be a sufficient explanation of the frequent appearance of full-grown fish at the present time.

Scientific Novelties.

Following in the wake of the scientific novelties that have been for some time exhibited in our shop windows under the form of hygrometric or barometric flowers, which change color according to the varying conditions of the air, we note the appearance of "luminous flowers." These flowers are prepared with sulphurets of strontium, calcium, etc., and it is only necessary to expose them for a short time to sunlight to observe them become afterwards phosphorescent in the darkness.

Recently Messrs. Dagron & Gisclon have put forth a novelty in the shape of "sympathetic pipes." The bowl of a meerschaum may be colored a most beautiful chocolate in five minutes, by first tinting it with a solution of nitrate of silver in ether and alcohol, to which essence of roses and camphor are added. By these means any image or superscription painted on the pipe will gradually appear, like a photographic impression, under the influence of the light or heat of the burning tobacco. The images once made are permanent.

STEAM BOILER INSPECTION.

It is hardly necessary to point out that in the prevention of boiler explosions there is a double interest: first, that of the public, which looks to the preservation of life and property; and, second, that of the owner, who incurs the direct loss. The former interest is represented in the rules promulgated by the United States Government relative to boiler inspection, the stamping and testing of boiler plates, etc., of which a new code has recently appeared, and will be found in full in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 113. The owner's interest may be considered as specifically guarded by the private insurance companies, which take risks on steam boilers after proper inspection. Between these two safeguards there is the invariable distinction which always exists between official and private business, namely, that lack of thorough enforcement of regulations which in the latter case is necessitated by pecuniary considerations, absent of course in the former. And these considerations obviously affect both insurer and insured, the first gaining the premium, the second protection against loss, so that on both sides there is ample motive for rendering the examination of the boiler and adoption of the proper safeguards as thorough and well advised as possible.

For some twelve years past special attention has been given to the matter of inspecting and insuring boilers by the Hartford Steam Boiler Inspection and Insurance Company. This corporation regularly causes all the boilers placed under its care to be inspected by competent engineers once a year, occasional visits being made as is deemed necessary in the interim.

The business of the concern is conducted according to a carefully prepared system. On receipt of the proposal for insurance, together with the inspector's report, the boilers are classified, and accepted at a suitable rate of insurance, unless they are found by the inspection to be absolutely unsafe, in which case the applicant is furnished with a written statement of their condition. The policy of insurance which the company issues covers damage to boilers, buildings, stock, and machinery arising from explosion, and is a guaranty that the work of inspection has been thoroughly done. This last is further vouched for by the fact that the company has a pecuniary interest in its sufficiency. Twenty-seven inspectors, practical engineers, are employed, and these hand in monthly reports. In 1877, we learn that there were 34,000 examinations. The number of defects discovered amounted to 15,964, of which 3,690 were considered dangerous. The whole number of boilers condemned was 133. Among the things to which special attention is given are the following: Defective boiler plate, insufficient riveting and staying, external and internal corrosion, burned and blistered plates, deposit of sediment, incrustation and scale, patches, internal grooving, defective water gauges, blow-off cocks, overloaded and defective safety valves, pressure gauges, etc. At the company's rooms, in Hartford, there is what might be termed a boiler museum. The collection of specimens of defective plates, lumps and strata of deposit, corroded braces, plates taken from exploded boilers, etc., is an evidence of culpable carelessness and neglect. This permanent exhibition of boiler defects graphically proves not only the necessity for continual supervision and thorough investigation, but also the value of such constant study into the nature and causes of boiler accidents as is here being carried on. Engravings and descriptions of remarkable flaws, defective plates, and the peculiar forms of boilers after explosion, which have come under the company's notice, are frequently published and are of much scientific interest.

The annual reports are interesting compilations, abounding in facts, statistics, and the relation of observation and experience. A single instance, drawn from the records of the company, and here presented, will illustrate one of the many dangerous cases of incrustation and accumulation of scale occasioned by the use of impure water which, with other serious defects arising from other causes, have been brought to light. While every steam user knows how quickly deposits accumulate in the bottom and on the sides of boilers, few probably have encountered cases where feed water pipes have become choked by the gradual accumulation of foreign substances, as shown by the annexed engraving. This represents a section of water feed pipe taken from a boiler at St. Louis, in 1876, where water from the Mississippi was being used. The extent of the deposit which checked the flow of feed water is remarkably great. During 1876, out of 2,894 cases of incrustation and scale, 392 were regarded as dangerous and due warning given.

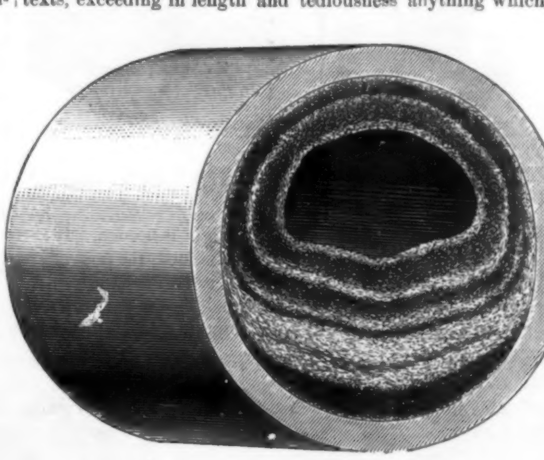
Pig Lead from Smoke.

The Joplin (Mo.) *Mining News* says: In the process of smelting the ore a great deal of it escapes in the form of smoke, or lead fumes, as it is more properly termed. It has been known for years that a large per cent of the metal was thus lost by its being sublimized and passing off into space. The white lead company was organized for the purpose of catching this smoke, and by passing it through an almost endless line of pipes of sheet iron and woolen bags, condense it. The result was that after an outlay of many thousand dollars and a year's experimenting they have succeeded in condensing the smoke or lead fumes into metallic lead, the same as steam is converted into water. The product of the fumes is a bluish, impalpable powder, which makes a splendid blue paint, pronounced equal to the corroded article. For the purpose of making it white several furnaces were built, and the blue product, with the aid of an immense heat, is again changed into lead fumes, which are again condensed and come out pure white lead. In the transforming of the blue lead into fumes, considerable pig lead is made. The object is to sublimize it all, but the heat is not powerful enough to do so.

Lord Granville on the Engineering Trade.

In proposing the toast of the evening at the annual dinner of the London Association of Foremen Engineers, at the City Terminus Hotel, recently, Earl Granville said:

When first invited to take the chair to-night I naturally inquired what were the objects of your association. It was not necessary to ask who the foremen engineers were. I knew that. They are not only what I may call the color sergeants of the skilled mechanics of the metropolis, but they are wholly unlike that delicate machine—the House—to which we have just heard that only ten pounds pressure can be applied. (Laughter.) They are more like the motive power of the most important trade in this country, the center of commercial and manufacturing activity itself, to which year by year and day by day is applied a pressure of something like 80 pounds to the square inch. I found no difficulty in divining the objects of the association, for from your rules and regulations they appear to be "friendly intercourse, intellectual instruction, physical good, abstinence from discussion on the politics of the trade, and a hearty desire to promote that good feeling between employers and employed which we conceive to be necessary to the success of both." (Hear, hear.) Now, it seems to me that these texts would be sufficient for any able writer to fill some folio volumes full of matter of interest and importance, and I cannot help thinking that even an humble individual like myself, if he really took the pains, might make an after-dinner speech upon these texts, exceeding in length and tediousness anything which



FEED PIPE CHOKED BY DEPOSIT.

has ever been heard in this new hall, or even within the speech-beaten walls of the old London Tavern, in which you formerly used to congregate; but as Sydney Smith says, "I will incline to the side of mercy," and content myself with only a few observations on a subject of the deepest importance both to you and to myself.

Unfortunately for me, I am not a great lessor of mineral property; but it happens that I am connected with no less than four iron works in Shropshire and Staffordshire which rent minerals. I am principal partner in one Shropshire concern, of which I am extremely proud to find that the vice-chairman of your dinner last year said we produced the best iron in England. We assume to ourselves the title not only of ironmasters, but of civil engineers, and I might say a great deal about the merits of our work; but I think it is just possible if I did you might think that my sole object in coming was to puff our own merits, and I might lay myself open to the suspicion that I was acting on that percentage and commission system which is one of the greatest evils of the mode of doing business at the present day. (Hear, hear.)

With regard to "friendly intercourse," I quite appreciate your desire for that, and in some ways it appears peculiarly desirable in regard to the foremen engineers of this metropolis. While you are intellectually superior to the great body of workmen, you have not the advantages of the great employers of labor, for you are from your position rather isolated in your respective works.

With regard to "physical good," I apprehend you consider the business of this association is by co-operation to defend the interests of your body, and by intercommunication to afford information where each member can find his services most acceptably employed. Lastly, one of your objects, and certainly not the least, is to afford some help and assistance to such of your members as are obliged, some temporarily, some permanently, to retire from active work.

In regard to the point of "intellectual instruction," that is the point, whether I speak of employers, managers, foremen, or workmen, on which will turn whether we are to retain the predominance in commerce and manufactures which we certainly at the present time enjoy. Probably some of you have read a commercial history and review of 1877 which appeared in the *Economist* of last week. I found it full of interest, and, with regard to the present time, painful interest. It entirely confirms the opinion which I have entertained—that not only in the United States, as in Europe, but throughout the whole world, and exceptionally so in this country during the last year, there has been a great and universal depression of business. With regard to those interests with which we who are here present are more intimately connected, it is hardly necessary for me to remind such an assembly as this that for the last three years we have been in a state of flatness which has seldom been paralleled. It is not necessary to go into the causes of this depression before men who think upon what concerns them. The first, however, was undoubtedly that fictitious inflation of prosperity which took place during the preceding years. The second was the bankruptcy of a great many nations, who have been good enough to swell that inflation by buying our products and paying for them in the most amiable way with the money they had borrowed from ourselves. Then there were three bad harvests, the year's civil dissension in France, and the dreadful war which has been going on in the East of Europe, and which still throws a shade upon our present prospects, though, I hope, one which will soon be dispelled—all these have had great influence on the present state of things. I feel very much inclined to agree with Mr. Walter in the cheerful view he took in speaking of the danger of competition from the United States, from France, from Belgium, and from Germany. There are a great many matters to be considered in regard to this competition. There is the geographical position of different countries, there is the cheapness or dearness of labor, there is the quality and propinquity of the minerals with which they have to deal; and there is one thing which, I am certain, in the race which is to come, and in which I hope and believe we shall continue to be the champions and the victors, it is impossible to overrate, and that is, the importance of intellectual instruction, whether with regard to those who employ, the foremen, or the workmen of this country. (Cheers.) Another subject which you should keep in view is good understanding between employers and employed. (Hear, hear.) With regard to both these objects, it appears to me that you foremen engineers have great power in your hands to do good. I am sure that it is impossible for you to increase your intellectual instruction without its reacting both upon those above and those below you. No one has such facilities as you have in giving practical application to the discoveries of science; and none so much as you have that practical experience which often alone gives a real use and application to some of the highest and purest principles of science.

With regard to the feeling between employers and employed, no people are more aware of the difficulties which beset both. You can easily detect the nonsense which is spoken sometimes on one side, sometimes on the other. You know the folly of some employers who strive to lay upon the workmen the whole burden of the failure of old fashioned concerns on which no sufficient capital or brain work has been bestowed, to compete with other works on which ample capital and ample thought have been devoted. On the other hand, I am sure none will more quickly see or more deeply regret when workmen put forward some claim entirely opposed to the commonest rules of political economy, and which can only result in injury to their employers, in injury to their country, and in permanent injury to themselves—(cheers)—and I am sure you can be useful intermediaries and buffers, as it were, between employers and employed, and that it will be your object to promote a perfect understanding between them. I am aware of the importance of that self-denying ordinance of yours that forbids you to discuss the politics of trade, and one is aware of what a strong dissolvent general politics sometimes are; but, with regard to trade politics, I cannot help thinking that men placed in so singularly good a position for calm and careful consideration of some of the great problems upon which the success of trade depends might with propriety and advantage to all discuss them in such a society as this. I am sure you will allow me, in conclusion, to express with the greatest sincerity my good wishes for the prosperity of this association, whose real vitality is proved by the meeting in such numbers tonight in spite of the general depression.

The toast was drunk with great heartiness.

Two New Planets.

Professor Henry, of the Smithsonian Institution, has recently announced the discovery by Professor Peters, of Clinton, of a star of the tenth magnitude, hitherto unknown, in 10h. 43m. right ascension, 11° 50' north declination, with a daily motion north. This planet, discovered February 4, will carry the number 180, and its discoverer proposes for it the name of *Eunike*, in commemoration of the glorious victories won by the Russian armies in their strife for humanity.

Professor Henry, a few days later, reported that Professor Foerster, of Berlin, had announced the discovery by Palisa (February 7) of a planet of the eleventh magnitude in 11h. 2m. right ascension, 6° north declination, with a daily motion of 8m. north.

IN an article on Amylidenamine Silver Nitrate, by W. G. Mixture, in the *American Journal of Science and Arts*, the author states that, "if the corresponding ammonio compound be regarded as diammonium-argentammonium nitrate, the derivative from valeralammonia may be regarded as di-amylidenammomium-argentamylidenammonium nitrate." This perhaps settles it.

WE are indebted to Mr. W. C. Hill, Clerk of the Senate Committee on Patents, for the favor of useful public documents.

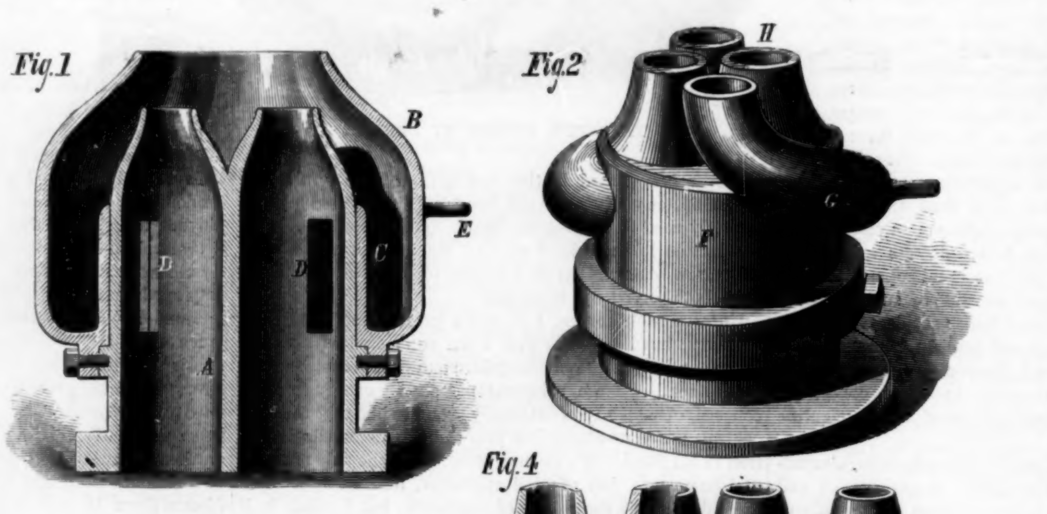
A Literary Congress.

It is proposed that a literary congress, to which the writers of all countries are invited, shall be held at Paris during the Exhibition. Preliminary steps have been taken by the *Société des Gens de Lettres* toward assembling this congress, and it is believed that the French Government is favorable to the idea, and will assign one of the halls in the Exhibition building for the accommodation of the members. The chief object will be the discussion of the questions relating to international copyright—a matter which is still as far from settlement as ever, notwithstanding the many diplomatic efforts that have been made. It is announced that Victor Hugo will deliver the opening address. A convention of the distinguished authors of the world, a large number of whom have already responded to the call, would be one of the most remarkable features of the Exhibition; though, if the "literary congress" should degenerate into a mere show, it would of course fail of its object and become as ridiculous as at present the plan appears judicious.

IMPROVED VARIABLE EXHAUST.

The invention herewith illustrated is a new exhaust or blast nozzle for locomotives or other engines, by means of which the blast may be rendered strong in order to increase the draught, or it may be so diffused as to produce little effect on the fire. Figs. 1 and 3 represent vertical and horizontal sections of the device, and Figs. 2 and 4 modifications of the same. It is placed in the front end of the locomotive, directly over the exhaust openings in the center casting. The upper part of the nozzle, A, in Figs. 1 and 3, is turned off conically, and the lower portion is cylindrical. A hollow cone, B, having a sleeve, C, projecting inwardly from its base, is placed upon the nozzle, A, and supported by a shoulder thereon. The open mouth of the cone is equal in area to both of the exhaust pipes, and projects a short distance above the nozzle, so that an annular space is left between it and the latter. The object of this arrangement is to produce a vacuum by the steam issuing from the center nozzle drawing the relief steam after it. The sleeve, C, is accurately fitted to the cylindrical portion, and ports, D, are made through both it and the nozzle. The distance through which the cone is turned is limited by a stop screw, and for moving the cone a rod leading from the cab is attached to the arm, E.

When a strong blast is required the cone, B, is turned so that the ports in the nozzle will be covered by the sleeve, C. The exhaust steam will then issue with great force from the nozzle passage, and, being concentrated, create a strong draught in the smoke stack of the locomotive. When the blast is not required the cone is turned so as to open the ports, D, permitting a portion of the exhaust steam to escape through said ports into the cone. The steam is thus deflected so that its force, and consequently the effect of the blast on the fire, is greatly diminished.



BRAINERD'S EXHAUST NOZZLE FOR LOCOMOTIVES.

In the modification represented in Fig. 2, instead of the cone, B, there is a solid sleeve, F, on which are two curved tubes, G. These last have ports opening through the sleeve, and communicating when the latter is turned with ports in the nozzle, the orifices of which are shown at H. When the sleeve is rotated so that the ports coincide, the steam escapes at all four openings, and is thus diffused. When the ports are closed it makes its exit as a blast from the nozzle apertures, H.

In Fig. 4, the upper plate, I, is movable in a horizontal plane about the boss, J, through which last the nozzle tubes, K, pass. On the plate, I, are other tubes, L, and ports are made through plate, I, and the plate beneath. By turning plate, I, the ports may be opened or closed, and the steam permitted to escape through two or four orifices.

Patented through the Scientific American Patent Agency, January 1, 1878. For further particulars address the inventor, Mr. George S. Brainerd, St. Albans Iron and Steel Works, St. Albans, Vt.

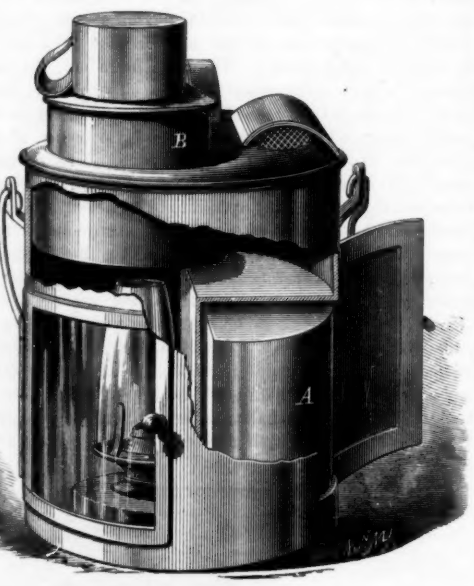
Explosive Dust.

Nature refers to the frequent explosions of malt dust in machines, and speaks of three explosions having taken place in four years, and these not due to any culpable carelessness, but ignited either by a spark from a piece of flint passing through the steel rollers or from some excessive friction on some part of the wood fittings.

The man in charge of the mill, on one of these occasions, stated that they were grinding at the ordinary pace about mid-day, with the window open and no gas turned on. The explosion was quite sudden, and the flame sufficient to singe the man's whiskers, the force so great that the door of the engine room was blown open, although the only opening between the two rooms was a small hole through which the shafting worked.

COMBINED DINNER PAIL AND LANTERN.

Our engraving illustrates a very handy contrivance for workmen who labor at night or in tunnels, mines, caissons,



HAIGHT'S COMBINED DINNER PAIL AND LANTERN.

or other localities where artificial light is needed. It consists of a dinner pail and lantern combined, the heat arising from the flame being utilized to keep the food warm. A is a compartment in which a box containing the food is placed. In the main portion of the pail a lamp is arranged, to which access may be had through the mica door. In the cover is a coffee receptacle, B, surmounted by a cup, which may be turned over the lamp whenever it is desired to warm its contents. Also in the cover is an aperture for the escape of smoke and heat. The usual bail is provided.

This device was patented through the Scientific American Patent Agency December 18, 1877, by Mr. Joseph Haight, of Port Chester, N. Y.

New Mechanical Inventions.

Mr. Thaddeus Hodgson, of Amherst, Nova Scotia, has invented a new Machine for Gumming and Sharpening Saws. A plate, bolted to the front of a work bench, serves as a support for the saw, and a sliding shaft, guided by a handle, carries a band pulley and an emery wheel, by which the grinding is done.

A horizontal Wind Wheel, invented by Mr. Martin Everhart, of Victoria, Texas, is so constructed as to automatically adjust itself to the force of the wind, and shut itself off entirely in case of a storm, while it may also be regulated by hand as desired. An independently rotating frame carries a pair of adjustable rudders, which hold it in any position required. At the forward end of the frame are two pairs of wings, working together, which are ordinarily held closed by a weighted cord, but expand and screen the wind wheel whenever the wind becomes too strong.

The same inventor has also patented a system of Applying an Irregular Power, such as that produced by the intermittent action of a wind wheel, to driving light machinery regularly. This is effected by an ingenious combination of details, by which two weights are drawn upward independently, and their cords wound upon separate drums, the driving machinery being automatically shifted by whichever weight, in its downward motion, reaches the limit of its movement first.

Mr. C. T. Porter, of Newark, N. J., has invented an improved Journal Box of cylindrical form, which has inclined cheeks, and is secured by wedges and gibs in a novel manner. The inventor claims that by his mode of construction he is enabled to place the supporting wedges as near as possible to the line of thrust, and that it renders a horizontal engine equal to a vertical engine in supporting the shaft in the direction of the line of centers.

An improved Axle Lubricator, invented by Mr. E. W. Moyer, of Bernville, Pa., is claimed to be economical of oil and to exclude the dust. The axle is made hollow, with an interior reservoir, exit duct, and grooves packed with wicks; the cap also has an inclined oil duct, and the hub is similarly supplied with oil receptacles and packed grooves.

Mr. G. W. Ford, of Elba, N. Y., has invented a machine for Expanding and Contracting Metals, for use in upsetting tires and similar work. The gripping attachments are exchangeable, so as to be applicable to various kinds of work, and the power is applied by a pair of hinged levers having a powerful purchase.

An improved Grapple has been patented by Mr. A. L. Larwill, of Beaufort, S. C. The object of the inventor is to improve the construction of grapples used for digging phosphate rock, or for similar purposes, so as to relieve the strain on the claws and bent arms, and to adapt them for cutting a suitable quantity of rock to be brought to the surface. This is accomplished by adding to the grapple one or a series of cutting blades or chisels, for loosening and separating the rock.

Some new improvements in Saw Mill Head Blocks, patented by Mr. W. H. Abrams, of Eugene City, Oregon, are intended to render the action of the saw mill, to a great extent, automatic. This is accomplished by certain ingenious peculiarities in the gearing, by which the clutches are shifted and the pinions turned, with each complete movement of the carriage.

An improvement in Lewises, or appliances for connecting heavy blocks of stone to hoisting ropes, has been patented by Messrs. Walter Graham and J. A. Dennison, of Annisquam, Mass. A pair of wedge-shaped jaws, connected by a pair of links to a single link, are secured in an undercut recess of the stone by driving a key between them, and may be detached by knocking out this key.

An improved Wagon Jack has been invented by Mr. Simeon Smith, of Deersville, Ohio. It consists of a fulcrum cam lever, connected by pivot links, with a vertically guided post.

A device for Cleaning the Mud Pipes of Steam Boilers has been invented by Mr. Henry Green, of Chilton, Wis. It consists in a shaft which extends through stuffing boxes in the heads of the mud pipe, and carrying several screw blades or wings, so arranged that when the shaft is in its normal position none of the blades will extend downward and become imbedded in the sediment. By rotating the shaft the mud and water are thoroughly agitated.

THE THREE-TAILED BIRTHWORT.

This singular plant, of which we present an engraving, taken from the *Garden*, is an arborescent evergreen shrub, with jointed branches swollen at the points of the stems. The dark green leaves are tapering, and from five to eight inches long. The flowers, which are produced in August, are of a maroon-red color outside and very dark purple-brown inside, and the lower margin is split into three diverging awl-like tails, resembling a three-pronged fork. These attain a length of four inches. Ghiesbreght discovered this plant in the forest of Chiapas, in the extreme east of Mexico. It requires a warm temperature, and will flower well in a small state. It is altogether scentless.

THE THREE-TAILED BIRTHWORT.

Effect of Sea Waves on Masonry.

A remarkable instance of the effect of sea waves on masonry is furnished in the case of the well known breakwater at Wick, on the coast of England. The height of the waves at this place was, it appears, several times measured and estimated, the result showing about forty-two feet from crest to hollow. Stones of eight and ten tons weight were, by these waves, carried from the parapet to the very top of the breakwater; and it was therefore determined, finally, to construct the outward extremity of the breakwater by depositing three courses of one hundred ton blocks of stone on the rubble base, as a foundation for three courses of large flat stones, surmounted by a monolith of cemented rubble built on the spot. The end of the breakwater, therefore, was in substance a monolith weighing upward of eight hundred tons, being about twenty-six feet by forty-five, and not less than eleven feet in solid thickness, cemented to the underlying rubble base. Incredible as it might seem, this huge monolithic mass succumbed to the force of the waves—it was, indeed, actually seen by the resident engineer to be bodily slewed around by successive strokes until it was finally removed and deposited inside the pier. Not only the upper portion, but the three lower courses of stone, forming a mass of 1,350 tons, were removed without breaking.

THE BAOBAB TREE.

Our illustration represents one of the largest trees known, the baobab, of Africa and Madagascar. The trunk is from 15 to 60 feet high, and from 70 to 75 feet in circumference. The lower branches extend horizontally outward, frequently to a distance of 60 feet, often hanging to the ground and concealing the trunk. The leaves are large and abundant and of a dark green color. The flowers are white, and the fruit soft and pulpy. Of the fibers obtained from the outer bark the natives make cordage.

A curious peculiarity of this tree is that scarcely any injury will destroy it. Fire scorching the exterior does not impair its vitality. Nor can it be injured from within, as it is quite common to find it hollow. Even cutting down does not exterminate it, for it continues to grow in length while lying on the ground, and its roots, which reach 40 or 50 yards from the trunk, retain their vitality. Although the tree attains an enormous age, Livingstone having examined one which he judged to be 1,400 years old, it is attacked by a disease which affects its woody structure, so in course of time its own weight causes it to fall in a mass of ruins.

THE BAOBAB TREE.

On Corns.

In a lecture at the St. Louis Hospital, Paris, on hypertrophy of the epidermis, M. Guibout observed that, while in callosities the hypertrophy takes place at the surface, in corns the hypertrophied part becomes pyramidal, and takes the form of a nail, with its point directed toward the deeper seated parts. This sharp point, lodged in a kind of cupola, which exactly boxes it in, has a tendency to penetrate into the substance of the dermis whenever the base of the corn is compressed. The portion of the dermis which is in permanent contact with the epidermic induration becomes inflamed and altered in character, its papillæ disappearing, so that at last it becomes a true matrix, destined to form deep, new, horny epidermic layers, in proportion as the more superficial layers are eliminated.

Changes of the weather often give rise to great pain in corns, which has been supposed to be due to their hygrometric nature, which, by causing their enlargement, adds to the suffering. But, in fact, the exacerbations are less severe during the time that it rains than they are for some days preceding; and they are also met with when the weather is about to change from wet to dry. These painful exacerbations of the pain of corns are quite as remarkable and as inexplicable as are those of rheumatic pains. The sole efficacious treatment is excision, but care must be taken that this is complete. The summit of the cone must be cut down to, so as to entirely empty the dermic cupola. And then it is quite necessary to destroy, by cauterization, the inner surface of this cupola, namely, the matrix of the corn, which will otherwise be reproduced.

The best caustic is sulphuric acid, of which we may deposit a drop, by a match or glass rod, on the excised part. If the corn recurs, the same processes of excision and cauterization must again be resorted to.

New Agricultural Inventions.

Mr. C. D. Page, of Greeley, Col., has invented a Portable Irrigating Apparatus, intended to facilitate the irrigation of land from open ditches. The apparatus is formed by a combination of side pieces and one or more flood boards for the ditch banks, with an end gate sliding between the side pieces, the whole being connected and constructed so as to be readily laid in the ground and operated.

Mr. O. O. Moore, of Medina, N. Y., has patented an improved Churn Dasher, which is perforated, pivoted eccentrically in a frame carried by the dasher rod, and provided with stops in such a manner that during the down stroke the dasher is horizontal, but drops into an inclined position on the up stroke, thus rendering the lifting motion easy.

An improved Corn Planter has been patented by Messrs. O. B. Seamans, V. A. Bryant, and Hugh Devling, of Coalville, Iowa. The improvements relate to the mechanism for operating the seed valves and marking the rows, and the special point covered by the patent is the lever arrangement by which the driving wheel is raised from the ground when the machine is moved from place to place.

Mr. J. C. Carpenter, of Council Grove, Kansas, has invented a Plow of such construction that the share, when worn, may be slipped forward one or more times, so as to enable it to be used much longer than with the usual arrangement. A strip of steel is inserted in the space thus left between the rear edge of the share and the forward edge of the mould board, and secured by bolts to a plate riveted to the mould board, the share also being adjustably retained by this plate.

An improved Hoe, for weeding cotton and other plants, has been invented by Mr. W. H. Eggleston, of Sugar Land, Texas. The blade is set at an inclination with the handle, is plated with steel on its lower side, has its forward edge beveled upon the upper side, beveled side edges, and projecting points upon the forward corners.

Aerial Navigation.

Mr. Brearey, secretary of the English Aeronautical Society, called attention, in a recent lecture, to some curious facts which those who are seeking solutions of the flying machine problem might profitably bear in mind. He stated that light as the atmosphere is in proportion to the weight of water, the rarer medium is capable of supporting a creature much heavier than itself, while water, 800 times heavier, only supported a fish of about equal weight, bulk for bulk. Supposing a fish bore the same proportional weight to its elemental medium as a bird does to the atmosphere, it would have to be made of something heavier than platinum. As it is a fish is really a bird without wings.

He gave some curious comparisons between different birds and insects as to the surface they presented to the atmosphere and their weight. Thus the gnat was of three million times less weight than the Australian crane, but presented in proportion one hundred and forty times more surface to the air; and between these two there were almost all gradations. In these investigations lay some of the most hopeful facts which seemed to render aerial navigation possible, and if man could get sufficient surface he could surely get sufficient machine power for propulsion. It was not so much a question of power as of the right application of power. There was also the question of balance. The manner in which a bird kept its balance, while its wings were being energetically worked alternately above and below its center of gravity, was marvelous. Mr. Brearey thought that with the example of the bicycle the question of balance would not present much difficulty.

He then touched on the application of steam to the navigation of the air. Until lately it had been thought that this was inadmissible as a motive power, because of the cumbrous method of its generation; but it had been declared that when steam could be applied with a weight not exceeding 20 lbs. per horse power, the problem would soon be solved. This had been accomplished, and they would hope the prognostication might be true.

KING HUMBERT, of Italy, has granted four annual prizes, of 5,000 lire (about $950) each, for the best productions in art, science, and literature, the awards to be made by the Accademia dei Lincei, at Rome.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, April 27, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	7 59 eve.	Saturn rises	3 44 mo.
Venus rises	3 18 mo.	Uranus in meridian	7 28 eve.
Mars sets	10 46 eve.	Uranus sets	2 20 mo.
Jupiter rises	1 22 mo.	Neptune sets	6 43 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	9 38 eve.	Sirius sets	9 17 eve.
Regulus in meridian	7 38 eve.	Procyon sets	11 28 eve.
Spica in meridian	10 55 eve.	Aldebaran sets	9 03 eve.
Arcturus in meridian	11 46 eve.	Algol (2d-4th mag.var.) sets	9 45 eve.
Altair rises	10 51 eve.	Capella sets	0 56 mo.
Vega rises	7 15 eve.	7 stars (cluster) sets	8 46 eve.
Deneb rises	8 18 eve.	Betelgeuse sets	9 50 eve.
Alpheratz rises	1 51 mo.	Rigel sets	8 16 eve.
Fomalhaut rises	4 31 mo.		

REMARKS.

Venus is directly south, a few degrees, of the cluster of small stars in Pisces Occidentalis, and is near the moon April 28, being 3° 19′ south. She is at her greatest western elongation May 1, being 46° 7′ west of the sun. Mars is now in the most attractive part of the heavens; all of the stars in our list, except Alpheratz and Altair, being visible with him. With Sirius, Betelgeuse, and Capella, he forms a large arc, which bends slightly to the southeast, Mars being about midway between the two last. Saturn is near the moon April 28, being about 6° south.

The variable star *Mira Ceti* is now at its minimum, being invisible, remaining so for a period of five months.

COLEMAN'S IMPROVED PIPE WRENCH.

Mr. Chas. C. Coleman, of Honolulu, Hawaiian Islands, is the inventor of the novel pipe wrench herewith illustrated, which is claimed to effect a more perfect inclosing grip than is usually the case with tools of the kind. The end of the handle is bent, and at the angle a large curved jaw is pivoted. To this a smaller curved jaw is hinged about midway its length, so that with the corresponding portion of the large jaw it forms, when closed, a nearly entire ring about the pipe or bar.

A link unites the outer end of the handle with that of the smaller jaw, so that when the jaws take hold, the movement of the handle acts through the link to press them the more closely together. The inner faces of the jaw are corrugated to prevent slipping, and a thread may also be cut across these corrugations, so that when desired the wrench may be made to seize a nipple and screw it firmly into place without marring or injuring the thread. The jaws so nearly inclose the pipe that a very strong grip may be had without danger of crushing or breaking the latter.

Further information may be obtained by addressing the inventor as above.

COLEMAN'S IMPROVED PIPE WRENCH.

Botanical Notes.

A Tree that Rains.—The Consul of the United States of Colombia, in the Department Leonto, Peru, has recently called the attention of President Prado to a remarkable tree existing in the forests near the village of Moyobamba. This tree, which is known by the natives as the *Tamai-Caspi* (rain tree), has completed its full growth, a height of 26 feet and a trunk diameter of about 3 feet. It is said to absorb and condense the moisture of the atmosphere with amazing energy, and to shed it from its branches constantly in the form of a dripping rain. So abundant is the water supply that the ground about the tree is like a marsh. The tree gives out most water during summer, when the streams are dried up and water is usually difficult to obtain. It is proposed to plant like trees in the arid regions of Peru.

The *Papaw* (*Carica papaya*), a tree widely cultivated in the tropics, and bearing an edible fruit, possesses the curious property of rendering newly killed meat tender in a few hours by being suspended among its branches.

Novel Botanical Collecting.—Dr. F. M. Hildebrandt, of Germany, has just returned from an expedition in Central Africa. On one occasion he adopted a novel, ingenious, and decidedly successful method of securing a collection of the organic products of a district. The tribe of Hataitas regarded him as a magician, and forced him to pronounce incantations on their unfruitful fields. That his charms might be effectual, he made the natives bring him specimens of all the animals and plants to be found in the neighborhood, which were shortly packed away in his collection.

The Ailantus, or "Tree of Heaven."—It is a well known botanical fact that this tree is diœcious, *i. e.*, the staminate and pistillate flowers are borne on separate plants, and that the male, or staminate, flowers are the only ones that emit the nauseous odor which makes the tree so objectionable. As the tree is a rapid grower and valuable for shade purposes, it has often been suggested that the destruction of all such as bear male flowers might serve to redeem its reputation. If an occurrence recently noted, and recorded in the Bulletin of the Torrey Botanical Club, should prove to be frequent, the proposed remedy would scarcely avail. The observer writes that he detected growing from the trunk of a tree, from which he had previously gathered specimens of staminate flowers, a small branch which had borne a panicle of well developed fruit. It would thus seem that there is a tendency in the tree to become occasionally *monœcious, i. e.*, to produce its male and female flowers on the same plant.

Botanical Statistics.—At a Botanical Congress held at Brussels, Professor Morren gave some interesting particulars of the number of plants known at different periods of the world's history. The writers of the Bible mention, definitely, some 500 different plants, while about 50 others are spoken of in general terms. Hippocrates gives the names of 234 plants; Theophrastus, 500; Dioscorides, 600; Pliny, 800. From the time of the latter writer until the sixteenth century little progress seems to have been made. About the latter period the works of Gesner appeared, in which only about 800 plants were mentioned; but, towards the close of the century, the number had increased to 6,000. In the next century we find the *Historia Plantarum* of John Ray, which treats of 18,665 different species. Linnæus, the great botanist, wrote in the eighteenth century, and clearly described 7,294 plants, distributed over 1,239 genera. In our own century, the increase of botanical knowledge has been most rapid. According to Persoon (1805–7), 25,000 to 26,000 species were known. In the catalogue of Steudel (1824) are enumerated 59,684 phanerogams and 10,965 cryptogams; in all over 70,000 plants. Loudon gives the names of 31,731 species and 3,732 genera; and Lindley (1846) divides the phanerogams into 66,435 dicotyledons and 13,952 monocotyledons. Later on (1853), the same author enumerates 12,480 cryptogams and 80,446 phanerogams. Lastly, in 1863, Bentley gives the number of known species at 100,000 phanerogams and 25,000 cryptogams. It is stated that about 40,000 distinct species of plants are now cultivated in greenhouses and gardens. When we consider the vast number of varieties into which some of the species are divided, the number of named plants must be truly enormous.

Origin of Chlorophyl in Plants.—The results of a careful investigation of this subject by Dr. Julius Wiesner, of Vienna, may be thus briefly summarized: Chlorophyl is derived from etiolin, or xanthophyl, with which it so far corresponds that both are ferruginous organic compounds, in which the presence of iron cannot be directly shown. The fact that the elimination of carbonic acid by blanched parts takes place to a greater extent in the dark than in such a degree of light as is favorable to the production of chlorophyl, and to the evolution of oxygen by the green parts of plants, renders it probable that carbonic acid has a direct action on the development of chlorophyl. The degree of light necessary for its production is the same for all the green organs in the same plant, though it differs widely in different plants. Up to a certain degree of intensity of light, the rate of chlorophyl production rises; above this it gradually sinks, so that we may say that there is a lower and a higher zero (in light) of chlorophyl production.

Circus Riding Taught by Machinery.

If anybody wishes to acquire the useful art of circus riding he has only to go to the Aquarium, in this city, and be taught, free of charge, by machinery. The only condition imposed by the philanthropic manager of the institution is that the learner shall practice in the presence of an audience, but this to many will be compensated for by the liberal offer of five dollars to the pupil who successfully rides around the ring three times standing on the back of an entirely reliable animal, a shade less spirited than the average rocking horse. The "machine" consists of a post erected in the middle of the ring, which freely turns on its vertical axis. This has two hinged arms, one reaching directly over the outer circumference of the circle, the other serving as a strut, and extending from the end of the horizontal arm to the center post near the base of the latter. In the upper arm are pulleys over which a rope passes. Of this one end is attached to a stout leather belt which encircles the waist of the learner, and the other is led inward and is held by the instructor. The pupil is thus prevented from falling off the horse, as the horizontal arm follows him around the ring, being impelled by an assistant who pushes the strut.

To appreciate what an utter slave "the human form divine" is to the attraction of gravitation it is only necessary to witness the frantic efforts of tyros to maintain their balance on the broad pad attached to the horse's back as the animal slowly canters around. For a professional rider to stand gracefully on one foot and fly around the circle seems the easiest thing in the world; and even when he turns somersaults and leaps lightly through hoops and over banners, there probably is not a boy in the audience who does not feel wholly competent to do the same thing even a little better. But to try the feats reveals the difficulty. A victim who had made several futile efforts assured us that he believed there was a new repulsive force inherent to the saddle which science took no account of. No sooner had he got his footing than his head felt too heavy and his feet too light, and in a second he was swimming in the air suspended by the rope, clutching wildly at the horse's tail to regain his position. An attempt to balance himself forward resulted in an involuntary leap over the animal's ears and another suspension in the air, this time in advance of the steed, followed by an affectionate embrace of the latter's head as the placid creature overtook him. The advantages of the "machine" in learning equilibration are quite evident, and, as we said before, a golden opportunity is now offered to obtain a vivid appreciation of what a circus rider's work is, and possibly to make five dollars.

Gardening in France.

There are over 6,000 men, women, and children engaged in growing early asparagus, lettuces, carrots, and the like in and around Paris. The rent of the land varies from $180 to $240 per acre, according to situation and irrigation plant. These market gardens are of comparatively small dimensions, and vary from 1½ to 2½ acres in extent. Taking the smaller size, the plant necessary to carry on business costs nearly $2,500, including large and small bell glasses, straw mats, glazed lights, frames, tools, baskets, horse, cart, and other necessary materials. The regular workmen, it is said, earn an average pay of about forty cents per day, with board and lodging, all the year round. Extra men receive about seven cents per hour, women five cents. Most of the men come from other sections, not so much for the sake of the wages, which are low for France, but in order to learn a business which they can turn to profitable account when they return to their homes after two or three years' service.

Amiens claims to be one of the oldest market gardening towns in France, vegetables having been grown there in the twelfth century—hundreds of years before a cabbage was grown in England. There are at present about 250 acres under cultivation, the yearly produce of which averages about $650 per acre. The cabbages often weigh from 40 to 50 pounds, beet roots 20 to 25 pounds, black radishes 12 to 20 pounds, and the turnips from 12 to 15 pounds. A stretch of about fifteen miles of the north coast, near Roscaff, is celebrated for its early artichokes, onions, asparagus and potatoes. England takes every year about 500 tons of early vegetables and 2,000 tons of onions, being about one third of the whole production. Four thousand souls make a comfortable living, and even grow rich, on the produce of some two thousand acres of land. Poitou, a neighboring province, has given its name to a gigantic cabbage much grown in western France, and largely used for cattle feeding. The leaves are carefully picked off in the autumn and at the end of winter, the plants being cut down in the spring. Gathered in this way, the Poitou cabbage will yield from 14 to 17 tons per acre.—*Boston Cultivator.*

The Use of the Uvula.

Professor Alfred H. Garrod, F.R.S., in a recent lecture, laid great stress upon the functions of the uvula, an organ present only in man and the anthropoid apes, and expressed his opinion that the uvula serves the purpose of preventing the food from entering the back part of the nose, if it should so happen that during the act of swallowing the individual should make a sudden effort at expiratory breathing. The uvula, being pressed back by the moving food against the posterior wall of the pharynx, would so retain a free communication between the mouth and the pharynx, at the same time that the nares are closed by the soft palate.

The Great Eastern.

The largest merchant steamships at present running are the English steamers, Great Eastern, Faraday, and Hooper. There are some very large steamships running regularly to New York from Liverpool, but none are so large as those mentioned above. The leviathan of ships, the Great Eastern, is one of the wonders of our progressive age, and a mighty proof of the energy, perseverance and skill of man. No other ship is worthy to be mentioned with her. She stands alone, a proud monument to her designers and builders.

She was built at London about twenty years ago, and cost a fabulous sum of money. She is nearly 700 feet long, 83 feet wide, and can carry 20,000 tons of freight. The next largest vessel's capacity is not over 6,000 tons.

Although of such immense size her lines are beautiful, and she sits upon the water as gracefully as a yacht. She has seven masts. Her engines, of the combined power of 10,000 horses, are a wonder to contemplate. Involuntarily the beholder exclaims, as he gazes upon the ponderous moving mass, "How could man ever fabricate them?" They

are without doubt the largest engines ever constructed. Her paddle wheels are fifty feet in diameter. Her saloon is lofty, of great size, and most luxurious in its appointments.

Although built for a passenger and freight steamer, and intended for the Australian trade, she has been used almost altogether in laying submarine telegraphs, proving altogether too large for profitable use as a merchant steamer. There is no doubt, in the event of Great Britain's going to war, she would be used as a transport steamer, being able to accommodate 10,000 soldiers with their baggage. Any one who has read Jules Verne's "Floating City" has a pretty correct idea of her vastness.

Domestic vs. Imported Broadcloth.

The question, why American woolen mills cannot produce as good cloth as the imported, is just now receiving considerable attention, and, as carriage builders are obliged to use imported cloths on all their best carriages, we have taken a lively interest in the subject. In procuring information as to why broadcloth cannot be made in America of a quality suitable for trimming our best carriages, we have conversed with several persons capable of imparting valuable information, with the following result: We were told by a gentleman who deals extensively in carriage goods, both foreign and domestic, that the American looms can produce just as good broadcloth as foreign, provided the same wool is used and the same care exercised as there is in cloth of foreign manufacture. This gentleman stated that the wool used in the best foreign cloths is of Australian production, while our domestic wool is inferior as regards length and quality. Imported wool cannot be used in the manufacture of cloth in this country, because the high duties on the raw material make the price of the cloth much higher than the imported can be bought for. There is another reason why domestic cloth is not as good as foreign, the blame for which must be attributed to negligence on the part of our mill owners. The cloth, after being woven, is not entirely cleansed or scoured of its accumulation of grease.

In conversation with a superintendent of a woolen mill in this city (and also inventor of a number of improvements connected with looms) who is familiar with the manufacture of woolen goods both in Europe and America, we were informed that although the Australian wool was longer and of better texture than our domestic, yet it is not necessary that it should be used for the manufacture of good cloths. Long wool is not required, short wool being the best. We therefore have domestic wool that is just as good for all purposes in manufacturing broadcloths as the Australian. One great trouble is on account of the limited capital of our mill owners, which prevents them from keeping a large and full assortment of different grades of wool in stock. Another, and the principal reason, is the great haste which is practiced in the finishing. On this account, the cloths are no sooner out of the looms than they are placed on the market. How detrimental this haste is to the goods will be more easily comprehended when the process of finishing is understood. In manufacturing broadcloths, the wool is first cleansed of all gum or animal fat, and is then oiled with lard or olive oil in order to be spun. In the process of weaving, more or less grease gets on it from the belts and machinery. After the cloth comes from the loom, it is run through scouring machines, in order to remove this oil and grease. In Europe this is done thoroughly, while in America so much care is not observed; therefore, the great objection to the use of American broadcloths for carriages consists in this neglect to remove all foreign matter, consequently the cloth catches the dirt more readily.

The trimming of any carriage is subjected to the most severe usage. It is exposed to the dust and dirt which accumulates upon it while driving in the streets, and which is ground into the cloth by the occupants and set by the action of the atmosphere. When a cloth is used possessing the deleterious qualities attributed to that of American make on account of imperfect scouring, it shows very quickly the presence of foreign matter that should have been removed before it was placed on the market. Could the trimming of a carriage be removed at will, and cleaned with little expense, the ill effects of imperfect scouring could, to some extent, be overcome; but when, as is the case, the cloth once placed must remain in position until worn out, or—in rare instances in these times of quick production—is removed to be replaced by new material, it is important that a cloth should be used that is entirely free from these defects.

Not many years ago our carriage builders were unable to procure an American make of varnish good enough for finishing. Now some American makes of varnish are unsurpassed, and even find a ready sale in London and Paris. The obstacles to the accomplishment of this were by far more difficult to surmount than those which hinder the production of good American broadcloths. Our looms and machinery are far superior to those used in Europe. We cannot pronounce our operatives less intelligent or lacking in skill. Then why should not this one hinderance in the manufacture of broadcloth be overcome by the proprietors of woolen mills, by placing in the market a broadcloth made from domestic wool, with American machinery and by American operatives, that shall be sufficiently good for the trimming of our best carriages?—*The Carriage Monthly.*

A NEW VEHICLE.

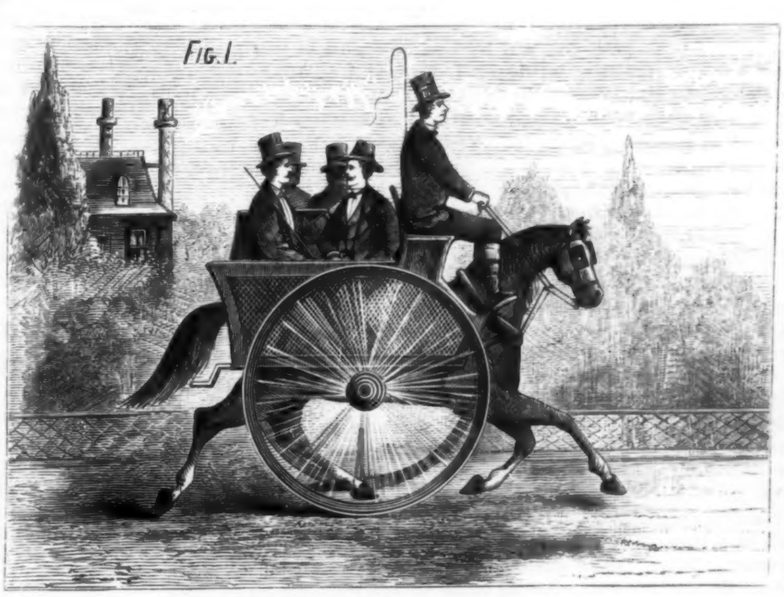
To the Editor of the Scientific American:

In these days of new rigs for ships there would seem to be no valid reason for not having something new for perambulating our parks. Mail coaches driven by their owners and tandems and double teams are expensive; they require showy horses and costly harness, and, last, not least, they

THE "EQUIBUS"—REAR VIEW.

require much space in which to navigate them. The vehicle I illustrate is eminently well adapted to these hard times, when our pockets and our patience are to be worn out by silver dollars worth only 90 cents. It carries four persons, besides the driver; it is compact, easy of draught, turns in the length of the horse, gives full control over him, is easy of access, makes no dust to annoy unless the wind be aft and the horse too slow to get away from it; is of cheap construction; requires very little showy harness, beyond the head stall; it protects the horse from rain, sun, and flies; if the horse falls you are no worse off than if he fell in a chaise or a dog cart, and last, not least, almost any horse will do, provided he has good legs, a fair tail, and good wind.

The vehicle may be made so that the passengers can sit in several different positions, first as shown in the drawing, back to back, as in an "inside jaunting car;" or they can all sit with their faces to the front; or two can sit facing aft and two facing forward, the first two getting in from the rear, and the others climbing up over the hub and wheel. One great advantage consists in taking hold of the load close to the collar; another prominent advantage is in the near proximity of the driver to the horse, whereby he can talk to him in a whisper, and pat him gently if he shows any signs of not liking his load. If the horse should manifest any mutinous spirit, he can neither rear nor kick to do any damage. All that will be required to make this the safest of all vehicles, after the hearse or the wheelbarrow, will be to balance the load so as to bear gently on the fore quarters or back, as in a chaise or two wheel dog cart. In crowded thoroughfares it will have no rival; the "gamins" of the street may pelt you and stand little chance of hitting the horse. To convert it into a sleigh you have only to chock your wheels and shoe them with short runners; but we are not recommending this vehicle for winter or for rough country roads. The saving to the community at large may be estimated by millions.



THE "EQUIBUS"—SIDE VIEW.

I estimate the cost of a dog cart at $500; a handsome 16 hand horse, $400, a nice Baker harness, $100; total, $1,000. My vehicle will cost about $250; my horse, say, about $150; my harness, $30; saving $570.

Now it is quite clear to my mind that all the Vanderbilts, Belmonts, Jeromes, Kanes, Camerons, Bonners, Purdys, and men of that sort who can afford it, as also many who cannot afford it, will want this vehicle, besides the vast crowd of speculators, jockeys, savings bank officers, and lobby members; so that at least ten million people of this demonetized nation will each save at least $500, making a round sum of —well, enough to pay off the national debt in silver coin. There will be a sad falling off in the price of horses and leather, and some of the fashionable carriage makers will have to go to the wall. But, take it all in all, this contrivance must be placed beside the invention of the telegraph, the telephone, the steam engine, the propeller, the monitor, and the double topsail rig for ships, which, though mentioned last, stands to-day among the most useful and humane inventions of the age. I have forgotten to allude to wages in connection with the what-shall-I-call-it; as the appearance of the horse will go for nothing, one man can take care of any number of heads and tails, and as owners will always want to drive themselves, no real coachman in drab coat and big brass buttons will be required. This will add another million or two to the general economy, to which this age seems to be rapidly and necessarily approaching.

EQUIBUS.

P. S.—Won't that be a good name for it?

New Inventions.

Mr. Chas. Jansen, of New York city, has invented a Vapor Bath adapted in shape to the entire body or any part, and constructed of outer closed and interior perforated walls, forming compartments to which steam is supplied by pipes.

Mr. Daniel Williams, of West Philadelphia, Pa., has invented a Funnel intended for use in filling opaque vessels, and arranged so as to prevent the liquid from running over or spilling when removing the funnel. A tapering plug, carried on a rod, which is operated by a journaled crank and handle, fits in the nozzle, and closes it when the vessel is shown to be filled by the liquid ceasing to flow. A second external nozzle forms an air space, allowing the air from the vessel to escape.

A new Burglar Alarm, operated by turning a knob or opening a door, has been invented by Mr. August Beck, of New York city. It consists of a ratchet wheel which engages a bell hammer, and is acted upon by two pawls, one moved by turning the door knob and the other by a spring released on opening the door.

Mr. Edwin Harkness, of Vincennes, Ind., has invented an improved Vault for burial purposes, which is made of concrete laid over a sheet iron or wooden form containing the casket; and a modification of this invention is a sheet metal vault, which protects the casket, and may be bedded in concrete or not, as desired.

An improved Gate Latch, which is capable of being adjusted to accommodate the sag of the gate, has been invented by Mr. W. F. Golden, of Morris, Ind. The catch pin is carried by a long and narrow base plate, slotted with a number of countersunk holes for receiving the screws, and may be raised or lowered, as circumstances may require.

Mr. W. M. Rich, of Rome, N. Y., has invented a handy Molasses Sampling Glass for exhibiting and testing samples of molasses and sirup, at the same time keeping the contents free from dust. It is a glass vessel having a funnel-shaped top, with symmetrically hinged cover-sections, through a recess of which a spatula is introduced.

An improved Fence Post, invented by Mr. D. C. Johnson, of New Providence, N. J., is intended for wire fences. The post is made of malleable iron, having divergent limbs or braces and a horizontal cross bar, all welded together and set in a solid base piece.

A Toy Revolver, designed to use paper percussion caps, and of very simple construction, has been patented by Messrs. August Dahler and F. W. Hoffmann, of New York city.

An Outside Window Blind of novel construction, which may also be extended so as to form an awning, has been invented by Mr. James Hester, of Knoxville, Ill. The blind is made of canvas or similar fabric, held in a frame and wound up on a roller, the lower part of the frame being hinged and connected by folding side sections to the casing, and having pivoted brace rods to throw it out as an awning.

Mr. S. T. Sanford, of Norton, Mass., has patented a Fastening for Shoes, formed by the interlacing of two pieces of leather slotted to form alternate strips and spaces, arranged with the strips of one piece passing through the spaces of the other, and formed upon or secured to opposite sides of the opening; the pointed ends of these pieces being secured by loops to a button placed in such position as to draw the parts snugly together.

An improved Rotary Valve for Brass Musical Instruments, which substitutes a positive action for the string mechanism in common use, has been invented by Dr. Theodore Artaud, of Jackson, Miss. The keys are acted on by springs, and operate curved arms having fixed pins which work in slotted levers directly connected to the rotary valves.

Mr. H. V. Caton, of Patricksburg, Ind., has made an improvement in the Running Gear of Wagons, designed to prevent straining and twisting when passing over uneven roads. The reach is made in two parts, having flanges at their connecting ends, and secured by bolts working in slots which permit a limited rotary movement of the forward part without twisting the other. The perch block is cast in one piece with the fifth wheel, thus preventing rattling.

Mr. R. B. Eason, of New York city, has made certain improvements on patent No. 193,858, previously issued to him, for a Car Axle Box, which relate to the arrangement of the oil chamber. This is hinged, and has a bottom perforation and sliding valve surrounded by a concave dishing to prevent leakage, and is provided with a spring clasp to secure it in closed position against the casing of the axle box.

A new Side Bar Wagon of simple construction has been patented by Messrs. William H. and Warren H. Colby, of Merrimacport, Mass. The side springs are pivoted at their forward ends to clamps rigidly attached to a rock shaft extending across the wagon, in combination with clips and butt springs so arranged as to resist pressure simultaneously and thus obviate jolting.

Mr. Albert Hall, of Cypress Hill, N. Y., has patented a Lamp Extinguisher, which is made distinct from the burner and of different sizes, so as to be applicable to any lamp. It consists of a slide placed over the wick tube, and having a lever cap or cut off, which is operated by a string passed through one of the holes in the bottom plate of the burner.

Homesickness as a Disease.

The last published volume of the *Dict. de Médecine* has an interesting article on nostalgia, by Dr. H. Rey. He regards it as a form of insanity. It is not often observed in childhood nor in advanced age, and is much less frequent in women than in men. It is most common in the young conscript drawn from the country, who enters the infantry; the town lad is too much accustomed to change and the bustle of life; while the cavalry soldier is too much occupied to have time to think over his separation from the place where his affections are centered. M. Rey states that the men of Bretagne are most liable to homesickness, as many cases occurring in those from this district as from the whole of the rest of France put together. The symptoms of nostalgia are, that the patient becomes sad and taciturn, forbears to eat, retires to weep alone, and gives himself up to long reveries of home. After a time, if he goes beyond this first stage, he begins to bear the aspect of ill health, and suffers from headache and sleeplessness; and if the disease still advances, delirium, prostration, diarrhea, and marasmus come on, terminating in death. Sometimes, he says, even old soldiers do not escape the malady. It is in hard times that this occurs, when fighting has to be done in retreat, and when other troubles are added to the bitterness of defeat; when he feels himself forsaken; when he is exposed to cold, is hungry, has to sleep on damp soil, and is suffering frightful thirst from his wounds; perhaps is taken prisoner, or droops under the diseases that spring from misery—scurvy, typhus, or dysentery; under these circumstances, the remembrance of the country he has left behind him, of the mother, the wife, or the home, awakens and brings a tear into the eyes of the bravest.

Catalpa Railway Ties and Telegraph Poles.

Mr. E. E. Barney, of Dayton, Ohio, gives, in a recent pamphlet, much interesting information in regard to the cultivation of this tree. The wood has a capacity to resist decay, especially when buried or in contact with the earth, that is almost marvelous. Fence posts made of it, that have stood in the ground 46 years, have been taken up and show no signs of decay; and we have a specimen of the wood taken from a post that has been standing two feet in the ground for 75 years. The specimen is perfectly hard and sound and is beautifully polished. The part of the post that was in the ground was decayed about a quarter of its diameter, the remainder being as sound as ever. The wood is light in weight, of compact fiber, has a handsome grain, takes a brilliant polish, and is well suited for ornamental cabinet work. Trees of four years' growth have no sap, and the older ones but a mere film, hardly thicker than paper. They are indigenous in Indiana and other parts of the West, where specimens may be found four feet in diameter next the ground, and with trunks of fifty feet without a limb. This size, however, is much greater than the average. It is very prolific and has a rapid growth, and these peculiarities would doubtless be more fully developed under favorable conditions of cultivation.

A tree large enough for four railroad ties can be grown from the seed in twenty years. They should be planted thickly so as to confine the growth to the trunk, and after a certain period thinned out by transplanting or otherwise. A general manager of one of the Western roads will plant 640 acres this year with catalpa for future railway ties, and from experience thus far, Mr. Barney is of opinion that with proper effort, a road may in 20 or 30 years grow ties enough for its own use, and at the same time thin out and sell enough of the smaller growths for telegraph poles, fencing, and other purposes, to cover all expenses of growing and manufacturing the ties. There are, of course, no complete tests of the lasting qualities of this wood in the position and service of ties. Thirty or forty years would be required for that. The durable nature of the wood, however, is beyond dispute; and from experiments made thus far, the catalpa ties are as firm under the rails as oak, and hold spikes equally well. It is claimed by Mr. Barney that a railroad once laid with them would require no renewals, to speak of, for fifty years, and that its annual outlay for repairs would be diminished $200 per mile, a saving that would add ten per cent to the value of the property.—*National Car Builder.*

FRENCH BAND SAW BLADES.

The band saw blade is a ribbon of steel, the usual length being from fifteen to forty feet, and from ⅛ to 4 inches wide. Its chief requisites are uniformity of temper, width, and thickness, a perfect joint, and freedom from all flaws.

Blades are liable to break from crystallization, imperfect tension, or carelessness of the operator in handling, and as a certain degree of temper is required for springs made of fine steel, so is the same temper necessary in band saw blades to insure durability and efficiency. To secure a uniform temper in a blade of steel from fifteen to forty feet long requires careful manipulation.

The appearance of a band saw blade does not indicate its temper, and it is difficult to distinguish tempered from untempered saws. A soft saw is comparatively worthless, as it will not retain its cutting edge. The best and surest test is to bend the saw or blade, and see if the elasticity indicates temper. The blades patented and manufactured by Messrs. Perin, Panhard & Co., of Paris, France, we are informed, are not injured by this test, but with proper handling prove to be durable and efficient. Further information respecting them may be obtained from J. A. Fay & Co., of Cincinnati, Ohio. See advertisement in another column.

The Tests of Magazine Guns at Springfield Armory.

The attention of inventors of magazine small-arms is directed to the competitive tests of these weapons in progress at the National Armory at Springfield, Mass. We are indebted to Lt.-Col. Benton for a copy of the following regulations governing the trials, to which all guns submitted will be subjected.

The regular tests are as follows:

For Safety.—The piece to be fired ten rounds by the exhibitor, or with a lanyard.

To Determine Rapidity with Accuracy.—The number of shots will be noted, which, fired in two minutes from the gun—both as a magazine gun and as a single shooter—strike a target 6 feet by 2 feet at a distance of 100 feet.

For Rapidity at Will alone record will be made of the number of shots which can be fired in one minute, irrespective of aim, under the same circumstances as above noted.

To Test for Endurance.—Each gun will be fired 500 continuous rounds without cleaning, using the magazine. The state of the breech mechanism will be examined at the end of every 50 rounds.

Each gun will be fired once with each of the following defective cartridges: 1. Cross-filed on head to nearly the thickness of the metal. 2. Cut at intervals around the rim. 3. With a longitudinal cut the whole length of the cartridge, from the rim up. A fresh piece of white paper, marked with the number of the gun, being laid over the breech to observe the escape of gas, if any occur.

To Note Effect of Dust.—The piece will be exposed in the box prepared for that purpose to a blast of fine sand-dust for two minutes. It will then be removed, fired 20 rounds, replaced for two minutes, removed, and fired 20 rounds more.

The rust test is as follows: The breech mechanism and receiver to be cleansed of grease, and the chamber of the barrel greased and plugged, the butt of the gun to be inserted to the height of the chamber in a solution of sal-ammoniac for ten minutes, exposed for two days to the open air, standing in a rack, and then fired 20 rounds.

Lastly, each gun will be fired once with 85 grains of powder and one ball of 405 grains of lead; once with 90 grains and one ball, and once with 90 grains and two balls. The piece will be closely examined after each discharge.

Those arms which successfully withstand the above will then be subjected to the following supplementary tests:

First. To be fired with two defective cartridges, Nos. 1 and 2, and then to be dusted five minutes, the mechanism being in the mouth of the blow-pipe, and closed, the hammer being at half-cock; then to be fired 6 shots, the last two defective, Nos. 1 and 2; then, without cleaning, to be dusted with the breech open, and fired 4 shots. The piece to be freed from dust only by pounding or wiping with the bare hand.

Second. To be rusted for four days after immersion, as before, and then fired 5 rounds with the service-cartridge; then, without cleaning, to be fired 5 rounds with 120 grains of powder and a ball weighing 1,200 grains; the gun to stand twenty-four hours after firing without cleaning, and then to be thoroughly examined.

Third. Facility of manipulation by members of the Board.

Fourth. Liability to accidental explosions of cartridges in the magazine.

Additional tests may be made by the Board to clear up doubts raised by previous trials.

Shoddy Leather.

It is probable that many persons have never heard of "shoddy leather," but it exists, and some who doubt it may perhaps have occasion to question their own *understandings*, or at least their *soles*. A few years since, a mode was devised of coarsely grinding new leather clippings, and, after forming it into a pasty mass, reducing it to dry, firm sheets of sole leather by hydraulic pressure. This article is considerably used in New England, especially for the interior portion of soles of the cheaper grades of boots and shoes; but we believe that these are not always sold on their own merits with the knowledge of the buyer. So, from this curious discovery, we have another evidence of the frugality of the arts in great saving of material formerly wasted—another stepping stone to the rise of manufacturers, merchants, and brokers to competency and wealth, and the employment and elevation in condition of thousands of working people—many of the latter becoming factory owners and men of large wealth. Let no one, therefore, be anxious to apply the term "shoddy" as a reproach, especially since the first cause for its epithetic use has long since departed. It is not wise to despise anything which has a probability of usefulness in the arts, nor to consider any business derogatory which aids to enrich the world, and contributes to the advancement and comfort of society.—*Am. Exch. and Review.*

Heat and Muscular Energy.

Professor A. Fick, of Wurzburg, has recently conducted a series of important experiments on the source of muscular power. The results he has obtained are very remarkable as showing the economy of the human machine, which after all is nothing but a form of heat engine. Helmholtz, it may be remembered, calculated some years ago that about one fifth only of the total work yielded by the chemical reactions going on in the human body reappeared in muscular action, while the remaining four fifths was manifested as sensible heat. It follows from this that a much larger proportion than one fifth of the work yielded by chemical force in the muscle itself can be employed in overcoming mechanical resistance, inasmuch as it is assumed that a great part of the oxidation takes place in other tissues, where mechanical work is out of the question and where heat alone can be the result.

Professor Fick's researches have been made with a view of determining what fraction of chemical force eliminated in the muscle is used in mechanical work, and he has measured in the muscles of the frog the mechanical work performed by the muscle, and the amount of chemical work that the muscle has yielded during the action. By means of a thermo-pile introduced between muscular masses, he found it possible to determine with great accuracy the absolute amount of heat produced by their contraction. To the fundamental law of Heidenhain, that a muscle contracting to its greatest extent evolves more heat the greater its initial tension, we may now add that, with equal initial tension, a muscle will evolve more heat if, by means of weights in equilibrium, greater tension be produced during the contraction. A muscle overcoming greater resistance works not only with more activity, but also with more economy than when occupied by a smaller effort. In an energetic muscular contraction, against as great a resistance as possible, the eliminated chemical force is about four times as great as the mechanical work it performs. With a less resistance the chemical is a greater multiple of the mechanical force, and with no resistance at all it is obviously indefinitely greater. The amount of heat produced by the eliminated force in an energetic contraction of 1 gramme of untried frog's muscle is sufficient to raise 3 milligrammes of water from 0° to 1° C. By adopting some very probable assumptions it can be inferred that the combustion of assimilated food, as far as the oxygen inspired is employed in producing chemical force, takes place almost exclusively in the muscular tissues.

Pigeon Living after the Removal of nearly all the Brain.

Dr. McQuillen describes the case of the extirpation of nearly all of the cerebrum of a pigeon by himself, and desires to place on record the fact that the subject not only survived the operation twenty-four days, but gradually regained its usual powers and habits of flight and its ability to feed itself and drink.

Only one such case is on record. He argues for the propriety and usefulness of such operations from the acknowledged existing uncertainties of the science.—*Proceedings American Philosophical Society.*

Fast Steamboats.

Several torpedo boats, of private manufacture, made trial trips on the Thames during February, and attained the extraordinary speed of 27 knots an hour, which is about the speed which is now attained by the fish torpedoes at the Royal Arsenal. This speed, which means range and precision as well as a saving of time, is three knots faster than that of any other torpedo yet produced.

A 20 lb. Salmon in a Halibut's Stomach.

A Wick (England) fishing boat landed a fine conditioned halibut, weighing 187 pounds, measuring 6 feet 8 inches in length, and about the same in girth. On opening the fish its stomach was found to contain a fine salmon in very good condition, and which weighed 20 pounds. The fisherman remarked that it was no wonder the halibut looked so well, seeing the sort of dinners he indulged in.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Portable and Stationary Engines; Boilers of all kinds; 45 Cortlandt St., N. Y. Erie City Iron Works, Erie, Pa.

Drawings and Engravings of Machinery a specialty. Pemberton & Scott. draughtsmen, 37 Park Row, Room 30.

Alcott's Turbine received the Centennial Medal.

Wanted.—Second Hand Screw or Lever Press for die work. 6 in. space, die 30 in. long. Address "Norman," New York city.

For Sale—36" x 48 Horizontal High Pressure Condensed Engine: very cheap. At Shearman's, 132 N. 3d St., Philadelphia.

For Sale—State Rights of Mathews' Monitor Windmill. Address D. Bennett Bancroft, Almont, Mich.

Four Horse Power Engine and Boiler, N. Y. Safety Steam Power Co.'s make; good as new: for sale at a bargain. H. M. Quackenbush, Herkimer, N. Y.

Wanted, Business.—Will buy Inventions or Manufacture on Royalty. R. K. Teller, Unadilla (N. Y.) Machine Works.

Address all orders for the Eclipse Engines, described in Sci. Am. of April 6, 1878, to Charles Sperry, Westbrook, Conn. Send for circulars.

Blower Wanted.—Second-hand Noiseless Fan to feed Boiler. Frank Haynes, Box 2739, Boston, Mass.

Manufacturers' special interest to address Bentel, Margedant & Co., Hamilton, Ohio, for the best and latest improved Wood Cutting Machinery.

Makers of Steel Thimbles will please send their address to Henry Kennedy, Fairview. Erie Co., Pa.

Wanted.—Woolen Mill Superintendent; one thoroughly conversant with the manufacture of all classes of woolen and worsted fabrics. Address, giving references as to character, ability, and experience, and expectations as to salary, P. O. Box 1926, N. Y.

For Sale—60" Boring Lathe, $100; 18" x 9 ft. Lathe, $185; 8 ft. Planer, $350. At Shearman's, 132 N. 3d St., Philadelphia.

$10,000.—A manufacturing company having room and power to spare, desire to find some additional staple article to make affording good profit, and that can be extended into a large business. Part of the necessary capital furnished if desired. Address P. O. Drawer 417, Bridgeport, Conn.

Corliss Engine Builders, with Wetherill's Improvements, Engineers, Machinists, Iron Founders, and Boiler Makers. Robt. Wetherill & Co., Chester, Pa.

24 inch Second-hand Planer, and 12 inch Jointer, or Buzz Planer, both in first-class order, for sale by Bentel, Margedant & Co., Hamilton, Ohio.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N.H.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

Carriage Axles, Springs, Bolts. Wanted full particulars and prices of machines used in the manufacture of above. Address Selby & Co., Longmore St., Birmingham, England.

Cornice Brakes. J.M. Robinson & Co., Cincinnati, O.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor, and Upright Mill Spindles, which can be stopped instantly; Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Ct.

Union Eyelet Company, Providence, R. I., Manufacturers of Patented Novelties on royalty or otherwise.

For the best Bone Mill and Mineral Crushing Machines—five sizes, great variety of work—address Baugh & Sons, Philadelphia, Pa.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use proves them stronger and more durable than wrought iron. See advertisement, page 270.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

Boilers & Engines cheap. Lovegrove & Co., Phila., Pa.

Weldless Cold-drawn Steel Boiler and Hydraulic Tubes. Leng & Ogden, 212 Pearl St., N. Y.

Skinner Portable Engine, Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

Walrath's Improved Portable Engines best in market; 3 to 8 H. P. Peter Walrath, Chittenango, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Painters' Rapid Graining Process. J.J.Callow, Clev'd, O.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Talley's Hydraulic Engine (see description and cut March 9, 1878), as a simple, cheap, effective and economical power, is unsurpassed, and is meeting with great success. Economy Hydraulic Engine Co., Kansas City, Mo.

Sperm Oil, Pure. Wm. F. Nye. New Bedford, Mass.

Bound Volumes of the Scientific American.—I have on hand bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 270. John Edwards, P. O. Box 773, N. Y.

NEW BOOKS AND PUBLICATIONS.

Die Sahara, oder Von Oase zu Oase. Von Dr. Josef Chavanne. A. Hartleben's Verlag in Wien, Pesth und Leipzig. 1878. Lieferung I. & II.

Two widely separated portions of the earth are at present, more prominently than all others, engaging the attention of explorers—the Arctic regions, and the mysterious interior of that dusky continent, Africa. To a portion of the latter country, full of importance and interest both from its extent and remarkable natural characters, the author has devoted his book entitled "The Sahara, or From Oasis to Oasis." There is, perhaps, no region of the globe about which more erroneous ideas popularly exist than regarding the Sahara. The notion usually held is precisely that of the old Roman geographers, who picture it as a boundless plain over which the wind continuously and sportively chases clouds of sand. The truth is, however, that we find here conjoined the sharpest contrasts of landscape character. Every gradation of landscape form is represented—Alpine scenery in no wise inferior to that of Switzerland, wild, deep, rocky valleys, large and extended mountains with snow-crowned summits, areas of luxuriant vegetation, a wealth of water which manifests itself under the form of lakes and rivers; then, a few hours farther on, almost imperceptibly, we reach bare, waterless plains, destitute of organic life and dotted with sandy dunes. A long residence and travels of many months in the northwestern part of the Desert have encouraged the author to sketch, in a popular, easily understood, and somewhat extended form, a picture of the Sahara in its entirety which shall be true to nature. It is not his intention to give a description which shall meet the demands of the exact sciences—the book is rather designed to present to the gaze of the general reader a correct view of the natural characteristics of every part of the Sahara, and the life, manners, and customs of its inhabitants. Where words alone fail to give a correct idea of a landscape, a type of the people, scenes of domestic life, or forms of vegetation, illustrations will be added to the text. The complete work will contain seven colored plates, sixty-four text illustrations, and a map of the Sahara. The entire work will be issued in 18 parts, of about 32 pages each, the first two of which have just reached us.

Unclaimed Money. A Handy Book for Heirs at Law, Next of Kin, and Persons in Search of a Clew to Unclaimed Money. By Edward Preston. London: Reeves & Turner.

The author, who has made a specialty of the subject treated of in this little work, has here brought together a large amount of curious, interesting, and valuable information on unclaimed money, eccentric wills, and such kindred topics. Although evidently prepared more especially to meet the wants of the English people, it may not prove less valuable to some of our own countrymen, particularly those who are connected by ties of consanguinity with the "mother country," and who may perhaps, for that reason, have "great expectations" from that quarter.

Arguments before the Committee on Patents of the House of Representatives, in February and March, 1878; pp. 355. Washington City: Thos. McGill & Co.

We have here the arguments of Messrs. J. H. Raymond, G. H. Christy, C. C. Coffin, H. D. Hyde, J. J. Storrow, George Payson, C. S. Whitman, A. H. Walker, Elisha Foote, Chauncey Smith, and S. A. Hurlbut, for and against the bill to amend the patent laws, now before the House of Representatives. As we shall review at considerable length elsewhere the facts and arguments presented by these gentlemen, we need say no more here than that the volume contains very much of interest to all who have the industrial progress and prosperity of our country at heart.

Messrs. W. Holberton & Co., of 117 Fulton street, this city, have issued a new and enlarged edition of their catalogue and handbook for sportsmen, which we can fully recommend to all desiring guns, fishing tackle, camp outfits, sportsmen's clothing, sporting books, etc., as an excellent manual showing the best and most approved articles of the kind. Mr. Holberton is an experienced fisherman, and his advice may be relied upon when selection of goods is left to him, and at the same time his knowledge enables him to offer a stock of all that is new and useful of the latest improvements in sporting tackle. The catalogue is finely illustrated and contains several excellent practical papers on angling, shooting, and camping. Its price is 15 cents.

Notes & Queries

D. C.—By the application of the following rule you can solve the examples: Horse power=(area of piston in square inches)×(speed of piston in feet per minute)×(mean pressure of steam during stroke in lbs. per square inch)÷33,000.—J. L. & Co.—Your best plan, before making a change, is to have your engine and boiler tested, since it is possible that the engine is wasteful, so that the boiler may be large enough.—J. W. S.—We could not do justice to the subject in these columns. If you have no opportunity to visit a rope-walk, consult some good encyclopedia.—S. B. and J. S. A.—See answer No. 67, Scientific American, April 20, 1878, and pp. 191 and 219, current volume.—C. E. T.—You will find the information desired in full on p. 38, vol. 36, of Scientific American. We have not much faith in such instruments.—A. S. C.—See Supplement, No. 109, p. 1738.—T. J. F.—See p. 408, Scientific American, June 30, 1877.—G. I. W.—You do not send sufficient data for the air pump, but you can calculate approximately how much steam your engine will use per minute, and then make an air pump of sufficient capacity to deliver from 35 to 40 times as much weight of water.—T. C.—It is difficult to give a simple explanation, free from analysis, that is satisfactory, and the subject would require too much space for these columns. You will find a popular description in Johnson's Cyclopedia.—J. D. W.—Any kind of hide that is thick enough can be made to answer. The best qualities of lace leather derive many of their advantages from the careful treatment to which they have been subjected. We are not positive about the sample.—J. G. R.—You should make your wishes known through the "Business and Personal" column.—J. J. J.—It is probable that the circulation will be imperfect with the arrangement described, unless the pipes are quite large.—S. E. W.—If you will address a manufacturer you may obtain information on the points referred to in your letter.—J. J. W.—Consult Nugent's "Treatise on Optics."—R. K. F.—The problem is one of those quibbles which can never be put to rest. It was discussed at length in the Scientific American, vol. 27, No. 21, p. 330, and other issues.—W. H. D.—See answers Nos. 19 and 22, p. 155, Scientific American, of March 9, 1878.—H. P. C.—The premises on which your questions are put are incorrect. It is impossible to straighten the rope.—W. B. P.—See Supplement, No. 20, p. 315.—"Cincinnati."—It appears to us that the building would be safer without lightning rods than it would be with rods put up in the way described.—C. E. O.—It may be that your magnet is not sufficiently powerful. It should hold about 1 oz. of iron. Use finer magnet wire, and wind it directly on the magnet wrapped with one layer of writing paper. See answers 19, 15, and 22, p. 155, Scientific American of March 9, 1878.—C. W. B.—It will be necessary to send sample of the water containing the animals referred to before we can answer you.—J. C. H.—There are a number of devices of the kind referred to in your letter. You can probably obtain addresses by inserting a notice in the "Business and Personal" column.

(1) E. W. asks: 1. What is meerschaum? A. Meerschaum (sepiolite) is a hydrous silicate of magnesia—silica 60·8, magnesia 27·1, water 12·1—100. 2. Where does it come from? A. It is found in Spain and several countries at the head of the Mediterranean.

(2) C. E. L. writes: I notice in the Scientific American of April 6, 1878, p. 209, an account of the performance of certain telephone circuits not connected in any way with the wires over which the concert music was being transmitted. There was one incident that the papers had no account of, that took place on the wire of Dr. Speare, which is worked with Morse instruments and does not approach nearer than 15 feet to the Western Union wires. He received the whole concert on an ordinary Morse sounder by placing a cylinder of cardboard over one of the coils, upon which he placed an ordinary ferrotype picture. The Doctor says he is frequently able to hear the Morse work from the Western Union wires in the same manner.

(3) J. F. M. writes: The water at this place contains a large amount of lime. How can I prevent scale forming in the boiler? A. You should use a feed water heater with sediment collector, and frequently blow off.

(4) F. M. C. asks: What will take the scale out of a steam boiler? The one I refer to is an upright of about 6 horse power. A. Without knowing the nature of the scale, it is impossible to recommend any specific remedy. By allowing the water in the boiler to become cool, after the fire has been hauled, and then letting it out, the scale is frequently so much softened that it can be brushed or washed off.

(5) M. E. J. asks: What effort, in foot lbs., does it require to draw a 14 inch plow, cutting 6 inches deep, through ordinary ground? A. For any special case, this could only be determined by experiment.

What will make a cheap black paint to dip harrow teeth in? A. We think tar thinned with turpentine would answer very well.

What book will assist me in making drawings of models? A. Professor Warren's works are highly spoken of. See also the series of articles by Professor MacCord in the Scientific American Supplement.

(6) H. K. writes: 1. In Barnes' "History of the United States," at the close of the description of the Atlantic cable, it is said that a message had been sent by a battery made of a percussion cap. Please explain. A. We believe the cap was filled with acidulated water, and in it was suspended a shred of zinc, thus forming a battery, in which the positive pole was the copper gun cap, and the shred of zinc was the negative pole. 2. Is moist earth a better conductor of electricity than water? A. That will depend on the kind of earth. 3. How is the Trouvé moist battery constructed? A. See Scientific American, November 24, 1877, p. 323.

(7) G. H. O. writes: I am making an electric machine, and a short time ago purchased a sheet of vulcanized rubber about 1/4 inch thick and 15 inches in diameter for the plate. This was cut round, and promised to do well. But it has commenced to curl up, and I cannot straighten it out. What is the cause of this, and is there any remedy for it? A. It may be that the rubber plate is not hard enough, or that it has been exposed to undue heat, and sagged out of form by its own weight; however, you can straighten it again by placing it on a flat sheet of metal, held on the surface of boiling water. The rubber plate will become softened by the heat of the boiling water, and when it lies flat on the metal plate, the latter should be removed from the surface of the water and allowed to cool slowly, with the rubber plate on it.

(8) E. F. G. writes: In the Scientific American of April 6, 1878, p. 214, under the caption "How some mysterious boiler explosions may occur," it is stated that some theorists have put forward the idea that the steam had turned to gas. Can that be possible? A. Yes; by decomposition of the steam into its elements, hydrogen and oxygen, by chemical or electrical means. The statement in the case referred to, however, was mentioned as an absurdity.

(9) J. C. asks: What is the simplest method of melting brass for small castings? A. In a plumbago crucible in a blacksmith's forge.

(10) E. W. M. asks: What is the way to apply diamond powder to the edge of a soft iron lap? The lap is to be used in cutting glass. A. With a brush and olive oil.

(11) S. S. C. asks: Is any greater injury done to the bottoms of boilers, and also to grate bars, by the use of coke as fuel than by the use of coal? A. Generally, no.

(12) J. H. A. asks: Will not a given amount of water (say 36 cubic inches) raise more water to a given height (say 40 feet) if applied on a breast bucket wheel 10 feet diameter under an 8 foot head, driving a force pump, than it would if applied to a hydraulic ram? A. The wheel will probably give as much as twice the efficiency of the ram. 2. Is not a suction and force pump better (for that height) than a force pump alone? A. We doubt whether one has any especial advantage over the other. 3. Does it require more power to force a stream of water, say 3/4 inch, through a large pipe, say 12 inches in diameter, than through a 3/4 inch pipe? A. Quite the contrary.

(13) A. J. B. writes; I have a small horizontal engine with cylinder 3 x 6 inches, running at 300 revolutions per minute, mounted on a horizontal boiler of the locomotive pattern, 16 inches in diameter by 4 feet long, with 11 2-inch tubes. 1. Is the boiler of sufficient capacity for the engine? A. We think so. 2. What shall I use to feed the boiler, an injector or a pump? A. An injector will answer very well. 3. What material is best for painting the engine? A. Black varnish made from petroleum can be used. 4. Will not this engine, with 70 lbs. of steam, and cutting off at ½ stroke, give fully 2 horse power? A. It probably will. In reference to other inquiries address the manufacturers.

(14) G. W. H. asks: If a ball were dropped from the surface toward the center of the earth, through a hole passing through the earth, would it pass beyond the center or stop when it reached its center? A. It would pass beyond, and return.

(15) J. W. A. asks: How many lbs. can a good engine raise 1 foot from the ground if fed with 1 bushel of coal? What is the amount of power stored up in that quantity of coal? A. Good engines require from 2½ to 3 lbs. of coal for each horse power developed per hour, or perform 1,980,000 foot lbs. of work, with the above amount of coal.

It is said that the temperature of an Esquimaux snow hut is sometimes raised to 90° Fah., partly by the heat from the bodies of its inmates, and partly by two or three lamps burning. If so, why does the hut not melt down? A. The statement can scarcely refer to the walls of the hut.

(16) T. W. G. writes: I am making a collection of coins, and would like a recipe for keeping them bright when exposed to the air. A. Thinned pale animé varnish is often used; dry and warm the coin and dip quickly. Photographers' unsensitized collodion also answers well if the coin is not handled.

(17) S. W. writes: I have read of a plan of felling trees by cutting through them with a platinum wire heated red hot by a battery. Please inform me further. A. The battery must be of sufficient power to readily heat the platinum wire to a very bright red heat; if the platinum wire is thin, less battery power is required to do the same work, but the thin wire, when heated, is easily broken.

What is the best brain food? A. That which is found to have the best effect on the system generally.

(18) J. W. P. asks: What is the system of laying out a steam cylinder? I would like to know how much space it takes for 1 horse power. A. It will depend on the pressure of steam and piston speed. Thus, calling A the area of the piston in square inches, P the mean pressure in the cylinder in lbs. per square inch, and S the piston speed in feet per minute,

$$\text{Horse power} = \frac{A \times S \times P}{33{,}000}$$

From this equation the proportions of cylinder for a given case can be determined.

(19) C. S. asks: Will you please define in plain language precisely what is the meaning of the phrase, "limit of elasticity" or "elastic limit" so frequently used in discussions on the strength and qualities of iron? A. As ordinarily used, the expression means the tensile force, in lbs. per square inch, that a material can bear without receiving an injurious set.

(20) A. G. C. asks: What substance is used with plumbago for coating the hulls of yachts, and what is the mode of applying? I do not mean a temporary coat to last just for a race, but a permanent coating. A. We are not aware of any mode of applying a permanent plumbago coating. It is usually put on with tallow, and only intended for special work.

What book gives information on rigging boats, names of ropes, in fact general information on the subject? A. Consult Luce's or Alston's "Seamanship."

(21) A. L. H. asks: Are locomotive engineers obliged to have papers? A. The regulations in regard to this matter vary on different roads, and you should make inquiries of the officials. We believe there are no State laws requiring locomotive runners to be licensed.

(22) E. B. J. writes: I have tried plaster moulds to run metal to make a medal. It does not produce sharp impressions. How can I make a copper mould? A. By cutting it out with die sinkers' tools.

(23) G. D. M. writes: Please advise me as to the best pipe for conveying water to house from well 250 feet distant. We laid new iron pipe 1 inch in diameter last July, and have never yet been able to use the water owing to flakes of rust and fine particles which appear in the water no matter how long it is allowed to run. The pipe is not exposed to the air, but in the well is covered with rust a quarter of an inch in thickness. The stones of the well near the surface of the water are also covered with a yellowish rusty looking slime. A. Use lead pipe lined with tin.

(24) J. F. asks: If I condense ten volumes of atmospheric air into one volume, and cool it, say, to 40°, then allow it to suddenly expand to the original ten volumes, what will be its temperature? A. The following formulæ are applicable to such cases, provided there is no loss of heat by radiation or conduction: T=absolute temperature of air before compression; t =absolute temperature of air after compression; V= volume of air before compression; v=volume of air after compression; P=pressure of air before compression; p=pressure of air after compression. Then $\frac{t}{T}\left(\frac{V}{v}\right)^{0.408} = \left(\frac{p}{P}\right)^{0.29}$.

(25) E. M. F. writes: I wish to have some metallic cylinders cast, about 10 inches long, $2\frac{1}{2}$ inches in diameter, and $\frac{1}{16}$ inch thick. Lead is too soft. What cheap metal can be moulded as thin and be moderately strong? A. Soft or yellow brass, or solid drawn brass tubing, might answer.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. T. B.—Principally a ferruginous clay. May be used as a cheap paint it properly calcined.—T. J. H.—It is a bituminous shale or clay slate. It will yield a small quantity of oil illuminating gas by destructive distillation.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Locomotive Strokes. By W. G.
Protection against Torpedoes. By F. P.
The Towne Scientific School. By H. H., Jr.
Is the Nation Safe from Invasion? By C. S.
The Weather and Rheumatism. By J. H.
Treatment of "Rusty" Gold. By J. T.
Claude Bernard. By H. M. D.
Galvanic Action. By C. P.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 19, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alloy, bronze, E. C. Kirk	201,586
Amalgamator, L. M. Boardman	201,321
Animal trap, J. McMahel	201,546
Ashes, separating breeze from, J. Coyne	201,390
Axle box, R. B. Eason	201,393
Axle box, J. A. P. Vanclain	201,469
Bag machine, G. O. Lackey	201,425
Bale band tightener, Sevey & Manz	201,361
Bale tie, F. M. Logue	201,431
Bed, camp, M. A. Stevens	201,463
Bedstead fastening, C. H. Goebel	201,343
Bedstead, wardrobe, W. Fay	201,337
Bevel, square, and level, W. P. Walter	201,371
Billiard cushion, H. W. Collender (r)	8,133
Billiard table cushion, H. W. Collender (r)	8,132
Bit brace, C. H. Amidon	201,379
Blanks, receiving and arranging, H. W. Bassett	201,483
Blasting powder, Graham & Ward	201,520
Blind, outside window, J. Hester	201,415
Blind stile mortising machine, Doane & Bugbee	201,506
Boiler, sectional steam, J. W. Hard	201,412
Boilers, removing sediment from, T. C. Purves	201,446
Book binding, I. Reynolds	201,450
Boot and shoe machine, N. J. Simonds	201,457
Boot, balmoral or laced, L. B. Stockbridge (r)	8,128
Boot legs, device for stretching, J. H. Walker	201,370
Brake, wagon, Keene & Van Order	201,423
Brick machine, J. A. Gamewell	201,515
Brick machine, P. H. Kells (r)	8,127
Bridle bit, J. Stanley	201,566
Broom brace, C. H. Butler	201,496
Bung and bush, J. Blair	201,491
Burglar alarm, A. Beck	201,382
Button hole cutter, A. J. Lytle	201,432
Button, lacing, G. W. Prentice	201,445
Cake holder and cooler, S. W. Larrabee	201,538
Can, metallic, Green & Wilson, Jr. (r)	8,126
Can spout, A. L. Fisher	201,513
Car, railway, J. C. Paul	201,585
Car starter, W. Jasper	201,421
Cars, draw bar for railway, G. F. Godley	201,517
Carriage, child's, J. A. S. Simonson	201,561
Chair, rocking, C. C. Nichols	201,440
Chimney cap, J. W. Taylor	201,466
Churn, J. Huebethal	201,528
Churn, O. O. Moore	201,438
Clamp, E. F. Gordon	201,407
Corn sheller, Scharnweber & Barkham	201,339
Cornices, mould for running plaster, J. Y. Brickey	201,493
Corpse cooler, G. C. Hill	201,525
Corset, I. W. Birdseye	201,490
Cotton opener and cleaner, R. Kitson	201,424
Cultivator sleeve manufacture, C. P. Buckingham	201,324
Cut off, self-adjusting, W. Lowe	201,358
Cylinder with steam jackets, Leavitt, Jr., & Jones	201,429
Depot platform, L. J. Swett	201,571
Diagrams, transmitting, J. M. Wolbrecht	201,473
Digging machine, J. Coast	201,499
Ditching machine, J. F. Watring	201,474
Dough mixer, J. M. Stanyan	201,460
Dredging tongs, C. A. Scanlan	201,530
Drill, grain, J. R. Finch	201,341
Drill grinder, A. K. Rider	201,449
Drills, making twist, C. F. Jacobson	201,530
Drilling, etc., subaqueous, J. H. Striedinger *et al.*	201,569
Egg carrier, Laflin & Elliott	201,426
Egg carrier, F. Schulze	201,453
Egg carrier, J. L. Stevens	201,568
Egg cup, W. Starkey	201,364
Electrical currents, C. H. Wilson	201,374
Elevator feeder, B. Marquis	201,543
Engine for cotton presses, C. E. Emery	201,397
Engine, rotary, L. Van Doren	201,574
Engine, rotary steam, A. Siegrist	201,456
Engine, wind, Croft, Sr., & Croft, Jr.	201,334
Fare box, M. M. Moore	201,437
Faucet, lock, F. C. Lillis	201,430
Faucet, measuring, Johnson & Everts	201,533
Fence post, D. C. Johnson	201,422
Fence post, D. K. Mabie	201,541
Fence post, metallic, E. C. McVitty	201,547
Fence wire, barbed, T. H. Dodge	201,507
Filter, G. H. Moore	201,354
Filtration, C. Gerson	201,516
Fire arm, Henry & Fraser	201,524
Fire escape, C. A. Sheldon	201,455
Fire escape, J. Stengel	201,567
Fish and animal trap, G. Davis	201,504
Flanging machine, Campbell & Richards	201,325
Flour and meal chest, sifting, C. Romine	201,557
Flue, H. R. Bash	201,484
Flue cleaner, boiler, F. I. Pearce	201,555
Flume, R. H. Campbell	201,326
Funnel, D. Williams	201,472
Furnace, gas, N. Will	201,581
Game apparatus, C. Eusten	201,398
Garment supporter, T. J. Carroll	201,327
Gas apparatus, C. Holland	201,527
Grain binder, A. S. Hoyt	201,346
Grapple, A. L. Larwill	201,427
Grate for fire places, J. Moore, Jr.	201,549
Gymnastic apparatus, J. S. Chamberlin	201,328
Harrow, J. K. Miller	201,435
Harrow, J. W. Pearson	201,554
Harrow, Smith & McCulley	201,363
Harvester, G. H. Spaulding	201,563
Harvester, C. Wheeler, Jr.	201,579
Harvester, cotton, I. Boone	201,384
Hat brims, machine for curling, T. Lees	201,351
Hat and cap, sweat leather, W. J. Van Horne	201,575
Hatchway, L. Pare	201,356
Haversack, J. H. Lambert	201,537
Heaters, register box for, J. Moore, Jr.	201,551
Hinge, lock, P. Adams, Jr	201,476
Hoe, W. H. Eggleston	201,395
Hog dressing machine, I. Boone	201,385
Horses, toe weight for, C. Ferrier	201,339
Horseshoes, W. Dickinson	201,335
Hose carriage, C. Castle	201,388
Hot air apparatus, E. Moreau	201,439
Hub boring machine, J. Kritch	201,350
Hub, W. H. Wright	201,583
Irrigating apparatus, C. D. Page	201,442
Ivory imitation, J. W. & C. M. Hyatt	201,348
Jewelers' soldering tweezers, C. F. George	201,404
Key fastener, J. F. White	201,373
Knitting machine, A. Reichenbach	201,447
Lamp, F. B. Squire	201,565
Lamp chimney, E. S. Drake	201,509
Lamp extinguisher, A. Hall	201,411
Lamp extinguisher, L. W. Swem	201,570
Lamp, shoemaker's, A. Rosenstjerna	201,358
Land roller, A. H. Ufford	201,368
Latch, gate, W. F. Golden	201,406
Latch, reversible, I. E. Van Benthuysen	201,573
Leather stuffing machine, J. W. Hildreth	201,526
Lewises, Graham & Dennison	201,409
Lifting jack, Tichenor & Dexter	201,467
Lifting jack, etc., A. W. Comstock	201,502
Lighting device, W. W. Batchelder	201,485
Lock, bag, A. Oberndorfer	201,552
Lock, permutation, G. W. Youmans	201,375
Lock, time, P. F. King	201,535
Lock, trunk, J. Arnold	201,480
Locks, striker for spring, W. H. Taylor	201,572
Lubricator, W. A. Clark	201,332
Lubricator, loose pulley, W. G. Beach	201,487
Lubricator, G. W. Farnham	201,402
Lumber, drying, G. Woods (r)	8,129
Lumber, running through flumes, N. P. Chipman	201,330
Machinery, driving light, M. Everhart	201,399
Manhole and cover, T. Kerr	201,349
Marble, artificial, J. J. Williams	201,580
Meats, powder for curing, E. Gorges	201,344
Metals, expanding and contracting, G. W. Ford	201,403
Mill for pulverizing, J. W. Hyatt	201,347
Mirror and other frames, G. Eastman	201,394
Mirrors, T. Carney	201,497
Moulding in sand, Aiken & Drummond	201,377
Motor, water, W. F. Eyster	201,511
Motor, water, G. W. Stith	201,464
Motor, weight, A. Barker	201,482
Mower, R. Eickemeyer	201,396
Mud pipe cleaner, H. Green	201,410
Musical instrument, valve action, T. Artaud	201,380
Musical top, T. W. Harrison	201,345
Nails, picture, W. E. Jones	201,534
Neck tie retainer, O. P. Hurd	201,419
Numbering machine, C. Ewing	201,401
Oil cup, A. S. Smith	201,362
Oiling wheel axles, H. D. Goodrich	201,518
Padlock, W. D. Spencer	201,564
Painting machine, C. T. Brandon	201,322
Paper pulp machine, Baxendale & Barry	201,486
Paper pulp machine, J. G. Moore	201,550
Pianoforte action, F. St. Amant	201,461
Pin, dowel, B. F. Allen	201,378
Planing machine, J. B. Stockham	201,366
Plant duster, J. O'Brien	201,441
Planter attachment, Armsworth & Brown	201,479
Planter, C. Berryman	201,489
Planter, O. C. Green	201,521
Planter, O. B. Seamans *et al.*	201,454
Planter, P. B. Doty	201,508
Plow, J. C. Carpenter	201,387
Plow, L. Eberle, Sr., *et al.*	201,510
Plow, J. Pollock	201,355
Plow, T. I. Wade	201,576
Plow, C. A. Weed	201,471
Plow cutter, Wansbrough & Speer	201,470
Press, cotton and hay, G. W. Soule	201,465
Press, hay and cotton, P. K. Dederick (r)	8,130
Printing machine, G. Rosquist	201,558
Printing, transfer sheets for, C. T. Moore	201,436
Pulping machine, F. A. Cushman	201,501
Pump and condenser, R. M. Marchant	201,542
Pump, ship's, J. Edson	201,336
Pump valve, Tregoning & Hastings	201,468
Railway, street, J. R. Beckett (r)	8,125
Rake, hand, J. Benedict	201,320
Rake, hand hay, D. J. Starrett	201,365
Range, J. Briggs	201,494
Sampling glass, molasses, W. M. Rich	201,448
Sash fastener, J. G. Beecher	201,383
Sash holder, G. W. Grafflin, Jr.	201,408
Saw guide, F. Clark	201,498
Saw mill head block, W. H. Abrams	201,376
Saw set, G. W. Atkins	201,481
Saw sharpening machine, T. Hodgson	201,416
Saws, fastening the ends of band, O. Pratt	201,444
Scarf ring, R. Waterhouse	201,577
Scissors, T. R. Wright	201,475
Screen, Altenburg & Hill	201,478
Screen, P. Finders	201,512
Screw driver, J. B. West	201,372
Seeding machine, Westcott & Halteman	201,578
Sewer gas trap, F. E. Cudell	201,391
Sewer pipe sockets, A. F. Foster	201,342
Shaft supporter for vehicles, E. L. Chamberlin	201,329
Shingle shaving machine, J. W. Davenport	201,503
Shirt, A. D. Marr	201,433
Shoe fastening, S. T. Sanford	201,451
Shutter fastening, P. N. Horsley	201,417
Skirt supporter, J. Jenkins	201,531
Sled, T. Graether	201,519
Sleigh, J. W. Post	201,556
Soldering tool, P. P. Haines	201,522
Spindle, bobbin socket, W. F. Hastings	201,414
Spoon, medicine, E. K. Walker	201,369
Spring, car, W. P. Hansell	201,523
Spring coupling, M. L. Ballard	201,381
Spring, door, Z. Cobb	201,500
Springs, utilizing worn out, F. Hutchinson *et al.*	201,420
Stalk puller, J. H. Smith	201,562
Steering apparatus, T. Spear	201,360
Stocking supporter, J. Jenkins	201,532
Stools, adjustable back for, T. J. Ross (r)	8,131
Stump extractor, W. K. Fuller	201,514
Sucker rod socket or drill grab, R. Briney	201,386
Suspender clasp, J. W. Smith	201,458
Suspender socket, C. J. Lauderbach	201,428
Syringe, hypodermic, T. S. Parker	201,443
Tachometer or speed indicator, E. Buss	201,495
Telegraph wire, insulated, M. H. Alberger	201,477
Telegraph wire insulator, J. Matthewman	201,544
Telephone, speaking, A. G. Bell	201,488
Thrashing machine, E. S. Churchman	201,331
Tile laying machine, J. I. & W. J. Mettler	201,548
Tobacco cutter, J. Farrar	201,338
Tobacco pulp, coating paper with, T. J. Ferguson	201,340
Tongue support, wagon, L. D. Brown	201,323
Toy revolver, Dahler & Hoffmann	201,392
Trace carrier, S. S. Sargeant	201,452
Track clearer, C. Bopp	201,492
Truck, car, S. Lord	201,540
Truck for street cars, S. Lord	201,539
Valve, Little & Smart	201,352
Vault, E. Harkness	201,413
Wagon bolster plate, Crocker & Wilcox	201,333
Wagon jack, M. J. Hurd	201,529
Wagon jack, S. Smith	201,459
Wagon, side bar, W. H. & W. H. Colby	201,389
Wagon top, R. W. Thompson	201,367
Wash basin valve, J. S. Gilbert	201,405
Washing machine, McGraw & Gilbaugh	201,434
Watch and locket swivel, B. T. Pace	201,357
Watches, calendar for, E. H. Hull	201,418
Watches, pendant for, F. Steffany	201,462
Water meter and motor piston, J. C. Dennert	201,505
Water wheel, turbine, L. D. Wynkoop	201,584
Wheel guard, G. R. Maugham	201,545
Wind wheel, M. Everhart	201,400
Windmill, F. W. Shellabarger	201,560
Window shade, T. H. Paling	201,553
Wire manufacture, W. Wilmsmann	201,582

!!New and Improved!! Engraving Process!!!!

Perfect Substitute for Wood-Cuts.

ARTISTIC PRINTING. FINE ELECTROTYPING.

Photo-Plate Company
63 Duane St. New York.

Can be printed on an ordinary Press. RELIEF PLATES in hard Type Metal for Newspaper & Book Illustration. Send Stamp for Illustrated Circular.

MUCH CHEAPER THAN WOODCUTS.

State where you saw this.

THE TELEPHONE. BY R. M. FERGUSON, F.R.S. Read before the Royal Scottish Society of Arts. Its Construction, Uses, and Working fully and philosophically explained, with four illustrations. History of the Telephone. The Reis Telephone. Bell's. Wonderful sensitiveness. Difference between the Galvanic and the Telephone Impulse. A curious experiment. Theory of the Telephone. Molecular Vibrations of Metals. Magnetic Musical Sounds. Cause of the Sound. New Form of Telephone. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 120. Price 10 cents. To be had at this office and of all newsdealers. Also, in the same number, a Visit to the Inventor of the Phonograph. The Practical Uses of the Instrument in Cheaply reproducing Music. How the voice of the Prima Donna and the Elocutionist may be multiplied and preserved to all time. Usefulness of the Phonograph to the Blind, to Advocates, and others. Price of the Phonograph. An Improved Form, etc.

FOR SALE.—A No. 2 GOLDING & CO.'S Self-inking Printing Press, 12 fonts of card and business type, borders and cuts; cost $72; almost new; can be had for $50, by addressing
A. J. BINLEY, 153 1st St., Albany, N. Y.

PERIN BAND-SAW BLADES.

"*Know all Men by these Presents*: That we, **Perin, Panhard & Co.**, of **Paris, France**, have this day withdrawn the agency for the sale of our **Band-Saw Blades** from Mess. Richards, London & Kelley, and Mess. London, Orton & Berry, successors to Mess. Richards, London & Kelley, Phil., and appoint Mess.

J. A. FAY & CO.

of **Cincinnati, Ohio, U. S. A.**, to be our sole and exclusive agents for the entire States and territories of the United States of America, with full power to prosecute all infringements and illegal use or abuse of our trade mark. Made in Paris, France, January 1, 1878."

Witnesses: **PERIN, PANHARD & CO.,**
W. TARAZIN. **Successors to Perin & Co.**

As will be seen from the above announcement, we have been appointed sole and exclusive agents, for the United States, of the **Celebrated**

PERIN BAND-SAW BLADES!

and can furnish any sizes and lengths that may be required, joined, filed, and set, ready for use. Special sizes and lengths, not in stock, will be imported—requiring about thirty days from receipt of order. All Blades will bear the trade Mark: **Perin & Co.** on one side, and **J. A. Fay & Co.** on the other. *Genuine Perin Blades* can only be procured from us or our agents, viz: **The George Place Mach. Ag'cy, New York; Utilies Baird, Pittsburgh; J. A. Fay & Co., Mach. Depot, Chicago; James Jenks, Detroit; J. A. Fay & Co., Mach. Depot, St. Louis; J. H. Woolsey, St. Paul; H. P. Gregory & Co., San Francisco. J. A. FAY & CO., CIN., O., Mfrs. of all kinds of Wood-working Machinery.**

COVERED BARN YARD AND FARM Buildings. Description and 4 illustrations of a Covered Homestead on a Norfolk (Eng.) Farm. Directions for Construction and Dimensions. Also How to Construct a Covered Barn Yard, with engraving, dimensions, etc. SCIENTIFIC AMERICAN SUPPLEMENT, No. 118. Price 10 cents. To be had at this office and of all newsdealers.

LADIES can make $5 a day in their own city or town. Address ELLIS MAN'F'G CO., Waltham, Mass.

Steel Name Stamps.

N. Y. STENCIL WORKS, 87 Nassau St., N. Y.

IRWELL RIVER BRIDGE, MANCHESTER.—J. G. Linde, engineer. 2 pages of engravings. SUPPLEMENT No. 76. Price 10 cents.

For New Illustrated Catalogue of Foot Lathes, Scroll Saws, Small Steam Engines and Amateur's Tools, send stamp to CHASE & WOODMAN, Newark, N. J.

25 **Styles of Cards**, 10c., or 10 Chromo Cards, 10c., with name. J. B. HUSTED, NASSAU, N. Y.

PUMPING. Rider Compression Engine. No steam, noise, or danger. Especially for suburban residences. Pumps 2,000 to 200,000 gallons water per day.
CAMMEYER & SAYER,
93 Liberty St., N. Y.

HOW TO BUILD A CHEAP CATAMARAN, with Malay Rig. Four illustrations. Full directions for construction and dimensions of a simple, fast, handy boat in actual use. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 117. Price 10 cents. Also, in same number, description and full dimensions of the new yacht Intrepid. To be had at this office and of all newsdealers.

Boult's Patent Reverse Motion

Paneling, Variety Moulding & Dovetailing Machine. Cuts Panels of any design or style of mould in the solid wood with neatness and dispatch.

Is a first-class Shaper, Edge, & Scroll Moulder. Does general Dovetailing with thick or thin stuffs. **Simple, Durable and Efficient.** Send for Pamphlet and Sample of work. Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the

B. C. MACHINERY CO.,
Battle Creek, Mich.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading **Mining, Manufacturing, and Railroad** corporations in the **United States and Foreign Countries. First Premium** wherever exhibited, and hundreds of testimonials of the *highest character*. **A NEW SIZE FOR PROSPECTING AND LABORATORY USE.** ALL STONE CRUSHERS not made or licensed by us, containing vibratory convergent jaws actuated by a revolving shaft and fly-wheel, are infringements on our patent, and makers and users of such will be held accountable. Address

BLAKE CRUSHER CO., New Haven, Conn.

WANTED Parties to represent us everywhere for our new Combined Plan for Operating Stocks. Profits sure. No "Puts" or "Calls." Liberal pay. No interference with other business. All kinds of bonds wanted. Circulars and private terms free. Lawrence & Co., Bankers, 21 Broad St., N. Y.

FORCE OF WIND. HOW TO ESTIMATE the Necessary Strength of Roofs, Towers, Tall Chimneys, etc., to withstand the Wind. The Solution of all Problems of the kind, with numerous Formula. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 109. Price 10 cents. To be had at this office and of all newsdealers.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N.Y., who control the patent for Green's American Driven Well.

VANDERBURGH, WELLS & CO.,
18 Dutch St., cor. Fulton, N. Y. ENGRAVERS' BOX-WOOD, MACHINISTS' PATTERNS & BRAND LETTERS.

The George Place Machinery Agency

Machinery of Every Description.

121 Chambers and 103 Reade Streets, New York.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).

The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that, were owners fully aware of the small difference which now exists between the use of Wood and Iron, in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address

CARNEGIE, BROS. & CO., Pittsburgh, Pa.

THE DRIVEN WELL.

Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent**, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
NEW YORK.

EAGLE FOOT LATHES,

Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.

WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

SALESMEN WANTED $125 A Month and Expenses. **CIGARS** SAMPLES FREE. Send 3c. STAMP to insure answer. S. FOSTER & CO. Cincinnati, O.

50 **Best** Mixed Cards, with name, in case, 13c., or 25 no 2 alike, 10c. Outfit 10c. Dowd & Co., Bristol, Ct.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND. **Worcester, Mass.**

$3 GOLD PLATED WATCHES. Cheapest in the known world. *Sample Watch Free to Agents.* Address, A. COULTER & Co., Chicago.

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by

WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

$1200 Salary. Salesmen wanted to sell our Staple Goods to dealers. No peddling. Expenses paid. Permanent employment. address S. A. GRANT & CO., 2, 4, 6 & 8 Home St., Cincinnati, O.

H. A. ROGERS, MACHINISTS' SUPPLIES,
19 John Street, N. Y. Best and Cheapest,
EVERYTHING IN THE LINE.

BARNES' FOOT POWER MACHINERY.

13 Different machines with which Builders, Cabinet Makers, Wagon Makers, and Jobbers in miscellaneous work can compete as to QUALITY AND PRICE with steam power manufacturing; also Amateurs' supplies. MACHINES SENT ON TRIAL.

Say where you read this, and send for catalogue and prices.

W. F. & JOHN BARNES,
Rockford, Winnebago Co., Ill.

DANBURY DRILL CHUCKS. Perfected and Price reduced. Manuf'd by the HULL & BELDEN CO., Danbury, Ct.

A VALUABLE PROPERTY FOR SALE

consisting of 10,000 acres of land, situate in the County of York, in the Province of New Brunswick, on St. Johns River and Shogomoc Creek. Land heavily timbered with Hemlock, Spruce, and Hard Woods. In connection therewith is a first-class Water Power Saw Mill, Seven Dwellings, Store House, Blacksmith and Carpenter Shops, and other improvements. Products can be marketed with equal facility in Europe or the States. To parties wishing to engage in the manufacture of lumber and bark extracts a rare opportunity is offered. For further particulars, address FRANK L. JONES, Owego, Tioga Co., N. Y.

PATENTS SOLD.

For terms, address EUROPEAN and UNITED STATES PATENT EXCHANGE, 200 Broadway, N. Y. Box 2801.

Patent Wood-working Machinery, Band Saws, Scroll Saws, Friezers, etc. Cordesman, Egan & Co., Cincin'ti, O.

"OLD RELIABLE." TO KNOW ALL about the **Best Pump** for Paper Makers, Tanners, Contractors, and for irrigation, send for illustrated pamphlet, 78 pages. HEALD, SISCO & CO., Baldwinsville, N.Y.

BRADFORD MILL CO.
Successors to Jas. Bradford & Co.
MANUFACTURERS OF
French Buhr Millstones, Portable Corn & Flour Mills, Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishing.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J.R. Stewart, Pres. W.R. Dunlap, Sec.
PRICE-LISTS SENT ON APPLICATION.

$57.60 Agent's profits per week. Will prove it or forfeit $500. New articles, just patented. Samples sent free to all. Address W. H. CHIDESTER, 218 Fulton St., N. Y.

LOWE'S GAS-BURNING BOILERS. Eleven years' success. Process for gas combustion is in construction of boiler, and as durable, and, with Lowe's Superheating Steam Drum attached, less fuel (of any kind), and first cost, will do the work, than any other plan of boiler or setting. Lowe's Straight Tube Feed Water Heater is warranted to give boiling feed water, and is simplest, cheapest, and best. LOWE & WATSON, Bridgeport, Ct., Boiler Makers and Engineers.

LOCKWOOD'S TRADE JOURNALS.

THE PAPER TRADE JOURNAL, Weekly, $4.00 per year.
THE AMERICAN STATIONER, Weekly, $2.00 a year.
THE WINE AND FRUIT REPORTER, Weekly, $3.00 a year.
THE JEWELER, SILVERSMITH AND WATCHMAKER, Monthly, $1.00 a year.
THE MILLER'S JOURNAL. The oldest and best paper devoted to the Milling, Flour and Grain Trades. Published monthly; subscription, $1.00.

The AMERICAN MAIL and EXPORT JOURNAL is devoted to the advancement of the American Export Trade. This Journal is the pioneer in the field it occupies. It circulates in all parts of the world, and is an unrivaled medium to reach the Foreign Trade. Published every month, in one edition, for all countries. Subscription, $2.50, postpaid to any country in the world. All communications addressed to

HOWARD LOCKWOOD, Pub.,
74 Duane St., N. Y. P.O. Box 5514.

ON THE PRESERVATION OF WOOD. By J. CLARK JEFFERSON, A.R.S.M. How to store timber. How to measure timber and judge of its quality. Causes and Prevention of Dry and Damp Rot. Durability and Preservation of timber in Mines. The three methods of Artificial Preservation: 1. Coating timber with Tar, etc. 2. Removing Sap by water or by steam. 3. Impregnating the wood by a solution of common salt, Sulphide of Barium, Sulphate of Zinc and Copper, etc. A valuable practical paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 119. Price 10 cents. To be had at this office and of all newsdealers.

VERTICAL SCIENTIFIC GRAIN Mills and Black Diamond Mill Picks are our specialties. Before purchasing elsewhere send for price list.

A. W. STRAUB & CO.,
2231 Wood St., Philadelphia, Pa.

PATENT MINERAL WOOL.

Incombustible. The best non-conductor. For illustrated description see SCIENTIFIC AMERICAN of January 12th.

A. D. ELBERS,
P. O. Box 4461. 26½ Broadway, N. Y.

BELT PULLEY,

Lightest, strongest, and best made. Secured to the Shaft without Keys, Set Screws, Bolts or Pins; also, *Adjustable Dead Pulleys* and *Taper-Sleeve Couplings*. Send for catalogue. Address Taper-Sleeve Pulley Works, Erie, Pa.

OTIS' SAFETY HOISTING **Machinery.**

OTIS BROS. & CO., No. 348 Broadway, New York.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 116. Price 10 cents. To be had at this office and of all newsdealers.

RUBBER TYPE! Cases of 125 movable letters, etc., with printing apparatus, $1.50 by mail; sample of Type and circular, 6c. Address RUBBER TYPE CO., Mallet Creek, Ohio.

Universal Hand Planer, Judson's Patent. Model makers, jewelers, and metal workers generally, find this tool of great value. Prices reduced. Send for illustrated catalogue of Planers, Iron Cutters, Shears, Punches, Universal Ratchet Drills, &c. Manufactured exclusively by OLD COLONY RIVET CO., Kingston, Mass.

THE DINGEE & CONARD CO'S
BEAUTIFUL EVER-BLOOMING
ROSES

We deliver **Strong Pot Roses**, *suitable for immediate flowering*, safely by mail, at all post-offices. **5 Splendid Varieties**, *your choice*, all labeled, for **$1**; **12** for **$2**; **19** for **$3**; **26** for **$4**; **35** for **$5**; **75** for **$10**; **100** for **$13**. Send for our **NEW GUIDE TO ROSE CULTURE**, and choose from over **500** finest sorts. Our **Great Specialty** is *growing and distributing Roses*. THE DINGEE & CONARD CO., *Rose-Growers*, West Grove, Chester Co., Pa.

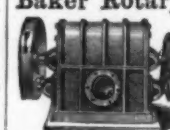
BETON CONCRETE IN ARCHITECTURE and Engineering, with 20 illustrations. Beton Bridge; Erie R. R. Portage Viaduct repaired with Beton; Beton Dwellings and Fountain, Brooklyn, N. Y.; Beton Church; Beton Culvert Lining, Erie R. R.; Beton Arches; Church Tracery, &c.; Beton-lined Railway Tunnels; Beton Pavements; Crushing Strength of Beton; Superior Strength of Beton Arches, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 118. Price 10 cents. To be had at this office and of all newsdealers.

STEEL NAME STAMPS 15 CTS. PER LETTER, POST paid. STEEL STAMP WORKS, New Haven, Conn.

65 MIXED CARDS, with name, 10c. and stamp. Agent's Outfit, 10c. L. C. COE & CO., Bristol, Ct.

NEW ROAD LOCOMOTIVES, BY Marshall, Sons & Co. General description and one engraving. SUPPLEMENT No. 56. 10 cents.

Baker Rotary Pressure Blower.

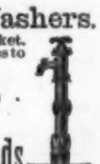


(FORCED BLAST.)
Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

$2500 a year. Agents wanted everywhere. Business strictly legitimate. Particulars free. Address J. WORTH & Co., St. Louis, Mo.

MARK Your Linen with Clark's Indelible Pencils. Sold at all stationers'.

BAILEY'S PATENT
Hydrants & Street Washers.



The best and cheapest in the market. Plumbers send for circular and prices to

Bailey, Farrell & Co.,
Manufacturers of
Water, Gas & Steam Goods
PITTSBURG, PA.

THE SCIENCE of LIFE,
OR, SELF-PRESERVATION.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive steel plate engravings, and more than 50 valuable prescriptions for all forms of prevailing diseases, the result of many years of extensive and successful practice. 300 pages, bound in French cloth; price only $1, sent by mail. The London Lancet says: "No person should be without this valuable book. The author is a noble benefactor." An illustrated sample sent to all on receipt of 6 cents for postage. Address DR. W. H. PARKER, 4 Bulfinch St., Boston. The author may be consulted on all diseases requiring skill and experience.

ALL KINDS OF **WOOD WORKING MACHINERY** IRON WORKING TOOLS & SPECIAL TOOLS, MANUFACTURED BY THE **H.B. SMITH MACHINE Co.** SMITHVILLE, BUR. CO., N.J. CIRCULARS FREE.

NEW UNITED STATES GOVERNMENT Rules in Respect to Boilers, Boiler Inspection, Stamping and Testing of Boiler Plates, Fire Apparatus, and Boat Lowering Devices and Life Preservers. Instructions to Inspectors, and Tests of Boiler Material are to be made and recorded. Requirements in Construction of Boilers. The Law in full, with List of Approved Fire Extinguishing, Life Saving, and Boat-lowering Apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 113. Price 10 cents. To be had at this office and of all newsdealers.

BIG PAY to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

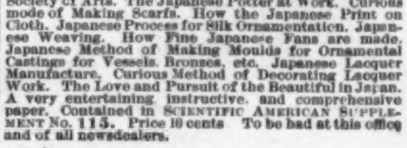
ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. SUPPLEMENT No. 59. Price, 10 cents.

JENNINGS' WATER CLOSETS
PRICES REDUCED. SEND FOR CIRCULAR.
94 BEEKMAN STREET NEW YORK

Amateur Workers
CAN FIND EVERYTHING THEY DESIRE IN
RARE AND FANCY WOODS,
AND SEVEN BOOKS OF
Beautiful Designs.

Send 3-cent stamp for our New and Enlarged Catalogue and Price List (4th edition, just issued), to

GEO. W. READ & CO.,
186 to 200 Lewis Street, ft. of 5th to 6th Sts., E. R., N. Y.



Small Tools of all kinds; also GEAR WHEELS, parts of MODELS, and materials of all kinds. Castings of Small Lathes, Engines, Slide Rests, etc. Catalogues free. GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

JAPANESE ART MANUFACTURES. By Christopher Dresser, Ph.D., etc. Paper read before Society of Arts. The Japanese Potter at Work. Curious mode of Making Scarfs. How the Japanese Print on Cloth. Japanese Process for Silk Ornamentation. Japanese Weaving. How Fine Japanese Fans are made. Japanese Method of Making Moulds for Ornamental Castings for Vessels. Bronzes, etc. Japanese Lacquer Manufacture. Curious Method of Decorating Lacquer Work. The Love and Pursuit of the Beautiful in Japan. A very entertaining, instructive, and comprehensive paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 115. Price 10 cents. To be had at this office and of all newsdealers.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

LACKERS' VARNISHES, WHITE SHELLAC.
W. ZINSSER & CO., 197 William St., N. Y.
MANUFACTURERS' SUPPLY STORE.
Agents for U. S. Salicylic Acid Works.

PUNCHING PRESSES. DROP HAMMERS AND DIES, FOR working Metals, &c. The STILES & PARKER PRESS CO., Middletown, Conn.

AHEAD OF ALL COMPETITION.

Seven Sizes for Hand Use. Weighing from 32 to 51 lbs. Three Sizes for Horse Power.

These Machines did an amount of work on the Centennial Grounds equal to 10 years of ordinary use, without loss of time for sharpening or repairs—completely distancing all competitors in that celebrated trial of 6 months duration. GRAHAM, EMLEN & PASSMORE, Patentees and Manufacturers, 631 Market St., Phila., Pa.

ASBESTOS

Liquid Paints, Roofing, Steam Pipe and Boiler Coverings, Steam Packing, Sheathing, Fire, Acid, and Waterproof Coatings, Cements, etc. Send for Samples, Illustrated Catalogues, Price Lists, etc.
H. W. JOHNS M'f'g Co.,
87 MAIDEN LANE, N. Y.

North's Pat. Universal Lathe Dog Is always in nearly perfect balance. Always stands up square with the work, and will not "skew." SHELDEN G. NORTH, 440 No. 12th St., Phila. Pa.

TURBINE WATER WHEELS.
New pattern. Increased percentage of power given. Estimates given on all kinds of Mill Machinery.
O. J. BOLLINGER, York, Penn.

ICE AT $1.00 PER TON.
The PICTET ARTIFICIAL ICE CO.,
LIMITED,
Room 51, Coal and Iron Exchange, P. O. Box 3083, N. Y.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

Steel Castings,

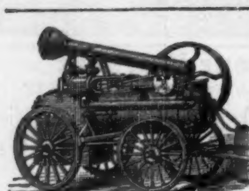
From ¼ to 10,000 lbs. weight, true to pattern. An invaluable substitute for forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, EVELINA STREET, PHILADELPHIA PA.

1874, 1875,
SCIENCE RECORD.

A few copies of these splendid books are offered at the following very low prices.
Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:

CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND,
TECHNOLOGY, THE USEFUL ARTS,
BOTANY AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MEDICA, THERAPEUTICS, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,
ASTRONOMY,
BIOGRAPHY AND NECROLOGY.

Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of $1.25 each. Address
MUNN & CO., PUBLISHERS,
37 Park Row, New York city.



THE PEERLESS Portable Steam Engine, for Agricultural and other purposes, from 6 to 10 horse power, and Domestic Semi-portable Engine, 2 and 4 horse power. Nothing cheap but the price. Send for descriptive catalogue and price list to
F. F. & A. B. LANDIS, Manufacturers, Cherry Street, Lancaster, Pa.

Bound Volumes
OF THE
Scientific American.

At present, I have on hand the following bound Volumes of the SCIENTIFIC AMERICAN, which I will sell at $1.00 each, either singly or by the quantity.

OLD SERIES.	NEW SERIES.	NEW SERIES.
Vol. 7....3 Copies.	Vol. 1... 5 Copies.	Vol. 15.. 7 Copies.
" 11....5 "	" 2... 6 "	" 16.. 8 "
" 13....4 "	" 3... 3 "	" 23.. 8 "
" 14....1 "	" 4... 6 "	" 32..16 "
	" 8... 3 "	
Vols. of the Old Series contain one year's numbers, and the New Series six months.	" 10... 9 "	
	" 11... 2 "	
	" 12... 9 "	
	" 13... 9 "	
	" 14... 7 "	

The books will be sent by express on receipt of price. Address all communications to
JOHN EDWARDS,
P. O. Box 773, New York.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. NEW YORK CITY
234 W. 29. ST.

WILSON'S NEW YORK CITY
COPARTNERSHIP DIRECTORY.
1878-1879. Vol. XXVI.

Containing the names of all copartnerships, special and otherwise, obtained from reliable sources, neatly compiled and arranged in alphabetical order, just from the press, is now ready for delivery. Very useful to Lawyers, Bankers, Merchants, and others. Price $2, and will be sent by mail, postpaid, on receipt of price.
Address orders to
THE TROW CITY DIRECTORY CO., 11 University Place, New York.
In preparation: WILSON'S BUSINESS DIRECTORY, Vol. XXXI., for 1878-9.

---

25 NEW YEAR CARDS, with name, 20c. 25 Extra Mixed, 10c. Geo. I. Reed & Co., Nassau, N.Y.

Randolph's New Ditcher.

Reversible, Double Ender. Doing work of sixty men, by horse power, at cost of six! Steam Machines, costing less than $10 per day to run, doing from $100 to $140 work. Circulars from RANDOLPH BROS., 111 Broadway, New York.

FRIEDMANN'S PATENT
INJECTORS and EJECTORS
Are the Most Reliable and Economical
BOILER FEEDERS
And Water Conveyors
IN EXISTENCE.
MANUFACTURED EXCLUSIVELY BY
NATHAN & DREYFUS,
NEW YORK.
Also Patent Oilers and Lubricators.
Send for Catalogue.

Cut Brass Gears, list free. Grant, 94 Beverly St., Boston.

WATSON'S NON CHANGEABLE GAP LATHE HAS GREAT FACILITIES FOR LARGE OR MEDIUM SIZE WORK. JAMES WATSON ... 1608 S. FRONT ST. PHILA.

TO ADVERTISERS! We will send free to all applicants who do any newspaper advertising, the THIRD EDITION of **AYER & SON'S MANUAL FOR ADVERTISERS.** 160 8vo. pp. More complete than any which have preceded it. Gives the names, circulation, and advertising rates of several thousand newspapers in the United States and Canada, and contains more information of value to an advertiser than can be found in any other publication. All lists have been carefully revised, and where practicable prices have been reduced. The special offers are numerous and unusually advantageous. Be sure to send for it before spending any money in newspaper advertising. Address N. W. AYER & SON, ADVERTISING AGENTS, Times Building, Philadelphia.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, &c. HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

LEFFEL WATER WHEELS.
With recent improvements.
Prices Greatly Reduced.
7000 in successful operation.
FINE NEW PAMPHLET FOR 1877,
Sent free to those interested.
James Leffel & Co.,
Springfield, O.
109 Liberty St., N. Y. City.

An assortment of
WOOD-WORKING MACHINERY
made by Richards, London & Kelley (dissolved); also, a number of first-class MACHINE TOOLS (nearly as good as new) of Philadelphia construction, on hand and for sale. For list or inspection of machines and estimates, apply at the works of JOHN RICHARDS & CO., 22d and Wood Sts., Philadelphia, manufacturers of Standard Gauges and other Implements.

THE ART OF MARBLING ON PAPER. By C. W. WOOLNOUGH. How it is done. What prevents the mingling of the colors. Kinds of mucilage used. Action of the Gall. Practical Directions. An operation beautiful in its simplicity, and instructive as exhibiting the action of a natural law. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 119. Price 10 cents. To be had at this office and of all newsdealers.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

ALCOTT LATHES, for Broom, Rake and Hoe Handles. S. C. HILLS, 78 Chambers St. N. Y.

Proof is Wanted by a careful man before trying a new thing. Our catalogue shows *ample* testimony from those using Excelsior Portable Printing Presses that they succeed well in doing their own printing and *save money*. Presses $3 to $100. Catalogue mailed, 6c. Kelsey & Co., M'f'rs, Meriden, Ct.

ROCK DRILLING MACHINES
AND
AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET FITCHBURG MASS.

RISDON'S IMPROVED
TURBINE WATER WHEEL
Yielded at the test of Turbines at Centennial Exposition the best results at all stages of gate. Send for circular to
T. H. RISDON & CO.,
Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

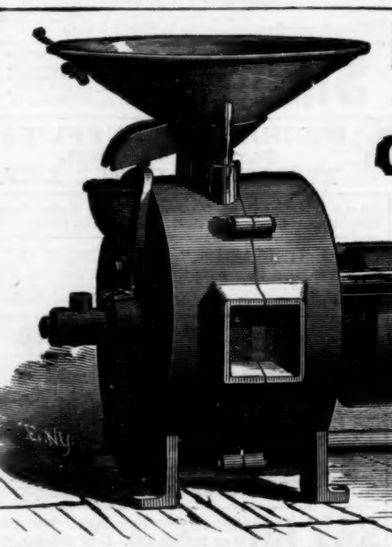
Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

MACHINISTS' TOOLS
Best quality at low prices. Radial Drills, Engine Lathes, Iron Planers, Car Wheel Borers, Hydrostatic Presses, Axle Lathes.
NILES TOOL WORKS, Hamilton, Ohio.

THORNTON'S ADJUSTABLE PIPE TONGS CHEAPEST
DEALERS IN TOOLS
WILL FIND THESE TONGS SELL AT SIGHT. TAKING MOST SIZES FOR LEAST MONEY. ADDRESS,
PANCOAST & MAULE,
245 SO. THIRD ST., PHILADA.
AND BEST MADE. SEND TO MAKERS FOR PRICES.

H. R. WORTHINGTON,
239 BROADWAY, NEW YORK.
Hydraulic Works, Van Brunt Street, Brooklyn, Manufactures Pumping Engines for Water Works. In daily use at 100 stations. Also Steam Pumps, Water Motors and Water Meters. See SCIENTIFIC AMERICAN SUPPLEMENT, January 27th, 1877. Prices largely reduced July 1st, 1877.



Harrison's Newly Improved
LIGHT STANDARD 20 INCH
Grinding Mill
Made at New Haven, Conn.
Grinding Capacity per hour,
6 to 40 Bushels.
Send for Illust'ed Catalogue.
Address
W. A. Foskett,
Administrator.

A GOOD CHANCE for the right sort of a man to engage in manufacturing—wood or iron working line. Address J. DUNCOMB, Erie, Pa.

ESTABLISHED 1844.
JOSEPH C. TODD,
(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. I also manufacture Baxter's New Portable Engine of 1877, of one horse power, complete for $125; can be seen in operation at my store. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

NOMENCLATURE OF BUILDING Stones and Stone Masonry. By J. JAMES R. CROES, WILLIAM E. MERRILL, and EDGAR B. VAN WINKLE. A paper read before the American Society of Civil Engineers. An exhaustive article on Stone Cutting and Masonry, various Methods of Dressing, and Tools employed, with 34 illustrations. 19 Tools, illustrated, with Dimensions and How to Make. Squared, Quarry-faced, Pitched-face, and Drafted Stones, Rubble, Cut, Pointed, and Crandalled Stones, etc. Axed or Pean Hammered and Patent Hammered Stones. Bush Hammered and Rubbed Stones. Diamond Panels. Rubble, Squared Stone, Range, Random, and Ashlar Masonry, 34 illustrations in all, with practical instructions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 113. Price 10 cents. To be had at this office and of all newsdealers.

PATENT
COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2d and 3d Avenues, Pittsburgh, Pa. 190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. GEO. PLACE & CO., 121 Chambers St., N. Y.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

FIRELESS AND HOT WATER LOCOMOTIVES. History of the inventions on this subject, giving Dates of Patents, etc., General Description and Working of Apparatus, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 111. Price 10 cents. To be had at this office and of all newsdealers.

CAMERON Steam Pumps
For Mines, Blast Furnaces, Rolling Mills, Oil Refineries, Boiler Feeders, &c.
For Illustrated Catalogue and *Reduced* Price List send to Works, Foot East 23d St., New York.

PORTLAND CEMENT.
ROMAN & KEENE'S. For Walks, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc. Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & Co., 53 Broadway New York.

SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scroll, Circular and Band Saws, Saw Attachments, Chucks, Mandrills, Twist Drills, Dogs, Callipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 88, 90 & 92 Elm St., Cincinnati, Ohio.

TUNNELS AND ROCK-BORING MACHINERY. By John Darlington. Particulars, Dimensions, and Methods employed in the Mont Cenis, St. Gothard, Hoosac, Sutro, Musconetcong, and Severn Tunnels. Rapidity of Work, Performances and Cost of Various Machines, Amount of Water, Compressed Air, etc., required, and nine illustrations. The Altenberg Zinc Mines, Aix-la-Chapelle; Perseberg Mines, Sweden; Shaft at Salzberg Altenwald; Marie Colliery; Pierre Dennis Pit; Stahlberg Musen, Prussia; Gouley Colliery; Dryrook Iron Mines; Sir Francis Level, Yorkshire; Frederichsegen Wrexam Mineral Mines; Johann Colliery, Prussia; Maesteg Tunnel; Cymbran; Dolcoath; South Crofty, Cornwall; Carn Brea, Cornwall; Ballacorkish, Isle of Man. For each Mine or Tunnel is given the Number of Holes in Heading, Character of Rock, Labor Employed, Time, Cost, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 109. Price 10 cents. To be had at this office and of all newsdealers.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector**, capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P. O. Box 979, Boston, Mass
N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

THE
Scientific American.
The Most Popular Scientific Paper in the World.
THIRTY-THIRD YEAR.
Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO.,
37 Park Row, New York.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.